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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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VOLUME 18 NUMBER 3/FEBRUARY 8, 1980

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also Astronautics.

01 AERONAUTICS (GENERAL) 275

02 AERODYNAMICS 282

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

03 AIR TRANSPORTATION AND SAFETY 287

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 288

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 288

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 290

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 291

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 292

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics.*

12 ASTRONAUTICS (GENERAL) N.A.

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS 292

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 293

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION N.A.

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE N.A.

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

19 SPACECRAFT INSTRUMENTATION N.A.
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 294
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 294
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 295
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 296
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 300
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 302
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 304
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 307
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 313
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 318
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 321
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 330
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*.
For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 332
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 334
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 335
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 336
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 340
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see 35 *Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 352
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and 85 *Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 361
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 364
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see 93 Space Radiation.

47 METEOROLOGY AND CLIMATOLOGY 367
Includes weather forecasting and modification.

48 OCEANOGRAPHY 374
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) *N.A.*
Includes genetics.

52 AEROSPACE MEDICINE 375
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 376
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric *research.*

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 376
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY *N.A.*
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences *(general);* computer operations and hardware; computer programming and software; computer *systems; cybernetics; numerical analysis; statistics* and probability; systems analysis; and theoretical *mathematics.*

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) 377

60 COMPUTER OPERATIONS AND HARDWARE 377
Includes computer graphics and data processing.
For components see 33 *Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 379
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS *N.A.*
Includes computer networks.

63 CYBERNETICS 381
Includes feedback and control theory.
For related information see also 54 Man/System Technology and Life Support.

64 NUMERICAL ANALYSIS 382
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 384
Includes data sampling and smoothing; Monte *Carlo method; and stochastic processes.*

66 SYSTEMS ANALYSIS 386
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 386
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; *optics; plasma physics; solid-state physics;* and thermodynamics and statistical physics.
For related information see also Engineering.

70 PHYSICS (GENERAL) 386
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 387
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 388
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 391
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 393
Includes light phenomena.

75 PLASMA PHYSICS 394
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 398
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 403
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 403
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 404
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 405
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 405
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 407
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 407
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 408
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 408
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 408
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

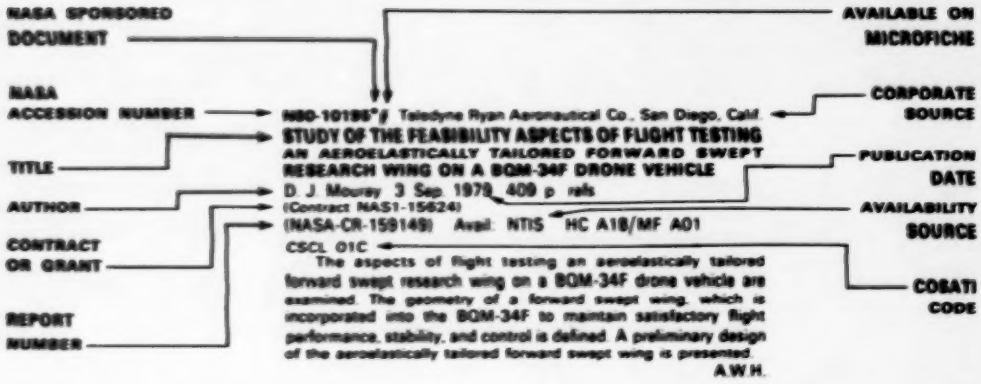
GENERAL

99 GENERAL 409

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-47
CORPORATE SOURCE INDEX I-53
CONTRACT NUMBER INDEX I-65
REPORT/ACCESSION NUMBER INDEX I-69

TYPICAL CITATION AND ABSTRACT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N80-10186*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINI-RPV (REMOTELY PILOTED VEHICLE) ENGINE DEMONSTRATOR PROGRAM

A.G. Bennett, Aerotech Co., *543 Auburn Dr., Auburn, Alabama* 36830 (DA0D4101; DAAJ02-77-C-0014)

Develop a lightweight multicylinder, two-stroke demonstrator engine to provide the technology base and source for future Army RPV engines for mini-RPV's. Address and solve the current engine problems of high vibration, high weight, high fuel consumption, short life and high cost.

Design, fabricate and test a 20 hp engine and deliver five engines o the government for evaluation. Design utilizes, to the maximum extent possible, high production rate components (cylinders, pistons, etc). Modify components as necessary to achieve program goals of 1.2 lb/hp, 0.8 lb/hp-hr sfc, 12,000 ft. altitude and 150 hour life.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, SUPPLIES TO BE FURNISHED

G. Leffler, Signal Co. Inc., Aireseach Manufacturing, *402 S. 36th St., Phoenix, Arizona* 85034 (FA78NA-5050; FA161450 (TRAIS NO.))

The contractor is charged with furnishing and delivering the government a Gas Turbine Engine P/N372980-100, Model 085-91C, S/N P9563. This unit is to be overhauled and put in certified condition according to the specification of the manufacturer. It should also be certified as serviceable by the Federal Aviation Administration (FAA).

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0003, FLUIDIC FLEX VALVE FOR RAMJET FUEL CONTROL

D.J. Schaffer, Signal Co. Inc., Airesearch Mfg Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DN881345; N62269-77-C-0352)

The basic objectives of this effort are to develop the analytical design criteria for flex duct valves for high fluid flow applications in general, and to conduct a practical demonstration on a flex duct valve for a 10,000 pound per hour range ramjet fuel control. This contract supports work unit ZA601, Agency Accession No. DN681080.

Analysis associated with a 500 pound per hour fuel metering valve indicated that the receiver rather than the nozzle should be the flexible member in the valve. This analysis will be reviewed again to determine the suitability of this approach for general application. In addition, the following parameters affecting valve design will be studied: duct aspect ratio, recovery nozzle design, flow forces, and leakage.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0004, INTERACTIVE COMPOSITE JOINT DESIGN

M.K. Smith, McDonnell Douglas Astronautics Co., *Long Beach, California* (DF136140; F33615-76-C-3058)

Working in an interactive mode with digital computers has been shown to drastically reduce elapsed time for iterative type solutions and reduce human errors. The design of composite joints is normally an interactive problem, where it is necessary to review geometrics, materials, and internal load and stresses of candidate designs to optimize design details. The objective of this program is to improve the design capability for joints and stress concentrations in composite aircraft structures by exploiting the interactive communication with digital computers. The most critical design problem in composite aircraft structures is that of the stress concentrations at joints and cutouts.

An in-depth investigation will be made of the use of interactive computer operation and computer graphics to facilitate the design of composite structures at stress concentrations. Double-lap, single-lap, scarf and stepped-lap bonded and bolted joints will be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, IN-HOUSE LABORATORY INDEPENDENT RESEARCH PROGRAM (ILIR) - ROTOR ACOUSTIC RESEARCH

I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0C5003)

The objective is to make maximum utilization of the information inherent in the radiated aerodynamically generated noise signature of rotors obtained by the newly developed in-flight noise measurement technique. These measurements provide noise pressure signals undistorted by reverberation, Doppler shift and other normally prevalent signal distortion mechanisms. These research efforts should provide the understanding of the noise generation mechanisms necessary to develop relatively simple mathematical analysis which can be used for rotor noise source and radiation pattern prediction.

A combined experimental theoretical effort will be followed utilizing tools developed to separate the noise generation mechanisms and allow concentrated effort to solve the complex problems in a step-by-step fashion. The first effort will be to define the impulsive noise generation mechanism and provide theoretical prediction capability. The second phase will concentrate on the blade vortex interaction noise and determine influence of rotor blade geometric parameters on rotor noise. Model rotor experimental efforts will utilize the laser velocimeter and other techniques such as schlieren and shadowgraph to verify flow field disturbance patterns.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0006, STUDY FOR SYSTEM ANALYSIS TO DEVELOP FUTURE CIVIL AIRCRAFT NOISE REDUCTION ALTERNATIVES

Unknown, Wyle Lab., *123 Maryland St., El Segundo, California* 90245 (FA77WA-3990; FA160340 (TRAIS NO.))

The contractor shall develop civil aircraft classification specifications which consider the details of aircraft design, noise

characteristics and performance to provide separately identifiable classes for noise regulations. For administrative and regulatory practicability reasons, the key result of this shall be the identification of the minimum practical number of classes which meets all requirements.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, THUNDERSTORM TURBULENCE HAZARD DETECTION AND DEPICTION FOR CONTROLLERS
Unknown, U.S. Dept. of the Interior, Bureau of Reclamation, *Bldg. 67, Denver Federal Center, Denver, Colorado* 80225 (FA77WA1-806; FA161235 (TRAIS NO.))

The acquisition of information on the location and severity of turbulence in severe convection storm situations is of vital importance to safety of flight and efficient management of the nation's airspace. Thunderstorm turbulence and gust front and low-level clear air wind shear detection and tracking have become feasible with the development of pulsed Doppler radar systems. The program requirements are for the development and testing of the detection, tracking and extrapolation of movement, and presentation of severe weather areas for use in the NAS.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION
W.G. Flannelly, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0E3772; DAAJ02-77-C-0039)

The coupled interaction between two or more helicopter dynamic subsystems has often been the source of vibration problems. This is particularly true when considering the helicopter as a dynamic system in which excitations can be generated by any or all of the propulsion system, the airframe or the drive system. The problems of vibration related interface compatibility in engine/drive system installations are usually complicated by the inherent coupling of the three (3) major multi-degree-of-freedom systems, i.e., engine, airframe and drive train. All background data and documentation of past experience lies in the hands of the airframe/engine industry, primarily the former. The technical objective of this contractual effort is to document industry experience to the degree required to permit plans/programs to be formulated as part of an overall government effort to accumulate data which will eventually lead to a solution of generic problems of this type.

Award sole source contracts to the major manufacturers of gas turbine powered US military helicopters, to review existing files, compile reports, memoranda, analytical design efforts, etc., and coordinate with appropriate engine manufacturers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, ADVANCED STRUCTURES CONCEPTS R&M/COST ASSESSMENTS
T.N. Cook, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3788; DAAJ02-77-C-0061)

Establish R&M and life-cycle cost characteristics of advanced structures concepts as applied to Army helicopters.

(a) Perform a failure mode and effects analysis of existing advanced structures design concepts to evaluate the effectiveness of these concepts for minimizing Army aircraft structures field problems and repair costs. (b) Fabricate representative samples of the most promising structural design concepts and conduct laboratory testing to evaluate R&M characteristics. (c) Perform a maintenance evaluation of the most promising structural design concepts. (d) Prepare a R&M design considerations document. (e) Perform a cost analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0010, THREE-DIMENSIONAL TRANSONIC DATA ACQUISITION AND EVALUATION
B.L. Hinson, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF052310; F49620-78-C-0068)

AF function - advanced aerospace vehicles. Deficiency - a lack of reliable experimental data for isolated wings in transonic flow that is suitable for use in developing and evaluating computational methodologies. Objective - to obtain a set of high quality experimental data for isolated wings suitable for evaluating new and future theoretical subsonic and transonic aerodynamic methods, to determine the influence of simple fuselage simulations on the wing aerodynamics, and to evaluate the level of accuracy and computational efficiency of representative versions of the new three-dimensional transonic computer codes. How work contributes - the acquisition of a reliable set of transonic wing data will provide a means for comparison of the various new and developing three-dimensional transonic codes which can differ in problem formulation, grid arrangement, finite difference schemes, and solution algorithms. With the availability of a good data base, methods can be assessed. Ultimately, the active use of these computer codes in aircraft design will depend to a large degree on the confidence developed through comparisons with good quality data.

Two supercritical wings, one of high and one of low aspect ratio, designed to produce well-behaved flows, will be tested in a high Reynolds number wind tunnel incorporating tunnel wall, boundary layer removal allowing simulation of true isolated wing conditions. The half span wings will be tested with and without a fuselage representation for a range of Mach numbers and angles of attack at which no extensive shock or pressure gradient induced boundary layer separation occurs. Both surface pressure (approximately 160 pressure orifices in each wing) and force balance readings will be taken. Also, a set of computational results will be generated and comparisons made for these test wings using the Bailey-Ballhaus small disturbance code, the Jameson full potential equation code, and the Jameson finite volume code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0011, OVERPRESSURE/GUST STRUCTURE RESPONSE
G.M. Campbell, Boeing Co., *Wichita, Kansas* (DF191400; F29601-75-A-1017)

The objective is to determine experimentally the effect of internal pressurization on the response of the KC-135A fuselage upper lobe frames and to correlate the resulting data with data obtained analytically using the AFWL NOVA-2 computer code.

A 10-foot long section of fuselage will be modified, instrumented and installed in the 19-foot diameter thunderpipe shock tube at Sandia Laboratories, Albuquerque, New Mexico. A typical upper lobe frame in the fuselage section will be analyzed using the AFWL NOVA-2 computer code to predict the response of the frame to various levels of blast overpressure for several levels of internal pressurization. Using these predicted levels of response as a guide, a series of tests will be conducted on the fuselage section in the shock tube, varying the levels of pressurization and blast overpressure parametrically. Results from these tests will provide an experimental data base for use in developing methods for generalized predictions for this type of structure. Specifically, pressure-time history test data will be used with the NOVA-2 code to correlate predicted and measured strains and displacements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

1.0012, OBSERVER RESPONSE TO HELICOPTER TYPE NOISE BELOW 100 HZ
S. Fidell, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DA0E3840; DAAK51 78 C 0013)

Examine the low frequency helicopter noise region to determine the applicability of the critical bandwidth concept on detectability; investigate infrasonic cueing effects; and incorporate the results in an existing helicopter detection computer program.

Conduct subjective tests in the laboratory using noise masking and noise signal inputs. Primary emphasis will be on frequen-

cies below 100 Hz to determine detectability effects of rotor fundamental frequency and several harmonics. Mathematical modeling will be developed describing the results.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0013, WAKE STUDIES RELATED TO WAVERIDER AERODYNAMIC SHAPES

M. Finston, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042900; F44620-76-C-0049)

AF function - advanced aerospace vehicles. Opportunity - obtain preliminary aerodynamic information about a possible new class of aerodynamically configured vehicles and reentry bodies. Objective - map the near wake pressure and temperature characteristics and obtain lift to drag data of aerodynamically configured shapes to enable designers and developers to predict possible uses for these new shapes. How work contributes - will provide basic aerodynamic data to enable flight vehicle designers to evaluate possible uses for these new shapes.

An experimental effort at Mach 4.3 and 6.3 is planned using the magnetic suspension of an aerodynamically configured pyramid shape to investigate the lift to drag and near wake characteristics and their dependence on Reynolds number. Prior year experiments indicated that magnetic suspension is the only viable suspension method; string or wire suspension methods produce an acceptable blockage and disturbance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, DIGITAL FLIGHT CONTROL SYSTEM ADVANCED TECHNIQUES EVALUATION

D.G. Bailey, Honeywell Inc., *2600 Ridgeway Parkway N.E., Minneapolis, Minnesota* 55413 (DF140040; F33615-77-C-2070)

Advanced high performance aircraft will be dependent on sophisticated flight controls integrated with other avionics for mission success. Improved survivability of the flight controls against combat damage, equipment failure, and electrical hazards will be required. Advanced digital techniqoes have the potential for satisfying these requirements but lack the necessary flight test verification that flight control system quality and integrity will not be impacted. The objective of this effort is to flight test demonstrate the feasibility of refinements to multimode control laws, analytic redundancy, area multiplexing, and fiber optic data links. This effort will reduce the technical risk and increase the confidence that these advanced digital techniques do not compromise flight control system performance and safety. It will also demonstrate the improved target tracking achieved through software refinements.

Existing multimode control laws in YA-7D (67-14583) will be refined through software reprogramming to optimize flight path performance during turning maneuvers. Software coding will be developed for fault tolerance through analytical redundancy and tested on the aircraft. A dais type area multiplexing data bus per MIL-STD-1553 will be developed to be compatible with the existing dual HDC-301 computers and flight tested for suitability of performing the flight stabilization and control functions. An optically coupled data bus will be investigated by exchanging the twisted shielded pair transmission lines with a fiber optic cable including optical line drivers and receivers and flight tested. A test program will be conducted to evaluate the potential susceptibility of the multiplexed data bus flight control system to lightning induced voltages. Using the multiplexed data bus, an improved dynamic gun sight will be added to further investigate target tracking capabilities of the multimode control laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, AIRCRAFT TRAFFIC LOADING ANALYSIS AND MODEL

W.J. Horn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0S8187)

To obtain aircraft traffic distribution and aircraft loading data essential to the development of the improved method of pavement design for both rigid and flexible pavements and to develop computer aids for considering traffic in pavement design.

The results of current studies associated with aircraft dynamic wheel loads, aircraft traffic distribution at civil airports, as well as earlier studies of aircraft traffic distribution at military airfields will be extended and supplemented if necessary to obtain the desired traffic distribution and loading information. Data in the form of aircraft type, load distribution, operational speeds, lateral traffic distribution, longitudinal traffic distribution and pavement temperatures will be obtained from these studies and supplied in a usable form to those elements having the responsibility of developing pavement design procedures.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

1.0016, IMPROVED AIRCRAFT/EXTERNAL STORE FLUTTER PREDICTION

M.A. Ferman, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF140420; F33615-77-C-3087)

This work unit supports the area of aircraft/external store flutter prediction. Establishing flight flutter safety for military aircraft carrying large numbers and different combinations of external stores is presently costly and time consuming. The objective of this effort is to reduce the time and cost for aircraft/external store flutter prediction. This reduction is expected to reduce the time and cost required for establishing flight flutter safety of military aircraft carrying external stores.

Add the capability to include empennage flexibilities in vibration and flutter analyses using the FACES (flutter of aircraft carrying external stores) computer program of AFFDL-TR-75-101. Also, provide program maintenance as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, FEASIBILITY DEMONSTRATION OF A RAFT SYSTEM

D. Meisner, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN781462; N62269-76-C-0273)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall, and subsequent flotation, of a high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surface ship or helicopter. This contract supports work unit PH104, Agency Accession No. DN681034.

It is planned to conceive, analyze, and design a raft system including its method of attachment, which is capable of meeting the objectives specified in statement of work SOW 3041-21; to fabricate feasibility test hardware, and to support NavAirDevCen personnel in subsequent flight tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, DESIGN AND FABRICATION OF RAFT/H46 INTERFACE FITTINGS

D. Meisner, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN881487; N62269-78-M-2229)

The objective of this task is to design and fabricate the H46 helicopter attachment fittings required to interface with the raft system. The fittings are internal to the airframe and are required to structurally transmit the mass and aerodynamic forces to the aircraft frame. This contract supports work unit PH104, Agency Accession No. DN 681034.

The approach is to determine the location of the major aircraft frame stations immediately aft of the cargo hatch. Structural bulkheads will be added as required to insure adequate load capability. Fabrication of structural bridges between major frames may be necessary. Emergency release shear pins will be included in the design.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0019, TACTICAL LANDING SYSTEM GUIDANCE TECHNIQUES (TLSGT)

A. Plotki, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0B3400)

To develop a tactical landing system (TLS) that has (a) high potential for providing satisfactory performance in the Army's severe tactical environment, and (b) sufficient versatility to permit determination of guidance system parameters necessary for safe helicopter instrument approaches under tactical operational conditions.

A flexible scanning beam landing system (A-SCAN) subsequently called TLS was developed which provides selectable glide slope angles, multiple localizers, variable horizontal and vertical course widths, optional DME, course softening, split or colocated siting, and altitude above touchdown. An in-house flight research program was conducted to evaluate scanning beam guidance techniques. This led to the initiation of the development of a lightweight (under 50 pounds) KU-band equipment to show contrasts among the microwave landing system, the marine remote area approach and landing system and the Army tactical landing system philosophies.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0020, WEIGHT AND COST IMPACT OF DAMAGE TOLERANCE CRITERIA ON NAVY AIRCRAFT

P. Bell, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881382; N62269-77-C-0174)

To make an analytical assessment of the weight and cost impact of damage tolerance criteria, specifically those of A.F. specification MIL A 83444, on a Navy fighter aircraft. This contract will support work unit ZA 601, 'Aircraft Technology', Agency Accession DN 681080.

The specification MIL A 83444, 'Airplane Damage Tolerance Requirements' will be analytically applied to the Navy F 14 aircraft. This aircraft was not designed to this specification so hypothetical redesign required to meet the specification can be quantitatively translated into weight and cost. The impact of this specification on the structural reliability, weight and cost of Navy aircraft can then be assessed.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, DISPERSED AND RECONFIGURABLE DIGITAL FLIGHT CONTROL SYSTEM STUDY

J. Boudreau, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF139720; F33615-77-C-3041)

This work unit supports advanced aerospace vehicles. The advantage gained by the work unit is the increased survivability of flight control systems due to hostile fire. The objective of the work is to develop strategies to increase aircraft survivability by dispersing and/or reconfiguring the flight control system. The development of these strategies should reduce the total number of components required to perform the flight control function, reduce the logistics cost in maintaining flight control systems, and significantly increase the survivability of military aircraft.

Analyze the dispersion of sensors about the airframe with appropriate structural filtering. Compare the use of multiple control surfaces to perform the flight control functions with the use of multiple actuators on single surfaces. Analyze the advantages of dispersing micro-processors about the airframe. Compare the use of a central processing computer with dispersed and non-dispersed micro-processors for synchronization, monitoring of failures, and size required. Develop reconfiguration strategies for detectable sensor failures, surface failures, and computer failures. Determine how to isolate where the failure occurred and what mode of reconfiguration to use, i.e., switch the bad unit out, switch to a redundant unit, approximate the function using other non-redundant units, or switch to a back-up mode.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, PARALLEL COMPUTATION FOR DEVELOPING NONLINEAR CONTROL PROCEDURES

H. Kaufman, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Systems Engineering, *110 8th St., Troy, New York* 12181 (DF140850; AFOSR-77-3418)

This work unit supports the enhancement of advanced aerospace vehicles. This work unit is developing techniques to allow the use of parallel processing elements for flight control laws. The objective of this work unit is to determine a parallel microprocessor computer system which will allow the on-line processing of non-linear equations. On-line non-linear computation would permit USAF aircraft to hand-tailor flight control laws which would improve their performance.

Using a Van der Pol system the control vector will be found using the variation of extremals method. The above algorithms will be modified so as to update the initial costate matrix by a parallel optimization procedure, and then by the parallel shooting algorithm. Using a representative high order flight control system, design and evaluate optimal controllers. Evaluate improvement in performance using nonlinear rather than linear equations of motion. Consider an adaptive system which is adjusted on-line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, ADVANCED FUEL DELIVERY SYSTEM

R. Anderson, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN889779; N00140-78-C-0059)

The overall objective is to design, develop and demonstrate a lightweight, compact, contaminant resistant, fuel delivery system for use on advanced augmented gas turbine engines. This contract will supplement developments reported under DN596806 and DN796803.

The contractor will obtain a fuel contaminant hardened vane pump/motor element to replace the gear-type element currently integrated into the unitized pump being developed and tested under contract N00140-75-C-0040. The element will be integrated into the unitized pump and will be bench tested to confirm satisfactory performance. Tests will then be run to confirm the capability of the pump to operate with unfiltered contaminated fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0024, H. E. PROJECTILE PROTECTION DESIGN CRITERIA VALIDATION

G.W. Ducker, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141800)

Most of the source material used in the development of the general specification and design guide of contract F33615-76-C-3006 is unverified or derivative information. This work unit will provide direct verification of the contents of these documents, or the basis for their revision. This will insure that the documents are both effective and sufficient for their intended use. The objective of this work unit is to evaluate the design guidance developed under this contract, validate the requirements and design procedures delineated in the documents and define any necessary modifications. The result of this work effort will be assurance that the standardization documents are adequate for procurement and design, and that the protection requirements are sufficient.

A test plan will be prepared which will reflect the requirements established in the system specification. Test specimens will be prepared in accordance with the design guide. Ballistic tests will be performed in the aircraft survivability research facility, with threats up to and including 57mm HE-T rounds. The results will be analyzed and appropriate modifications made, as necessary, to the specification and design guide developed under the referenced contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, MULTI-MICROPROCESSOR CONTROL ELEMENTS

J.E. Houtz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142560)

This program seeks to apply multiple microprocessors to aircraft digital flight control systems. State-of-the-art digital flight control systems are tailored to a general purpose digital computer architecture. This program will apply multiple microprocessors to mechanize a flight control system specifically tailored to flight control requirements. It is anticipated that this program will improve reliability of flight critical control systems and reduce control system hardware and software costs.

Evaluation modules will be breadboarded and candidate microprocessors and supporting hardware will be evaluated in the AFFDL/FGL development laboratory. A candidate microprocessor type will be selected as the basic unit for a flight control system design. Based upon the selected microprocessor type, a prototype modularized distributed microprocessor flight control system will be designed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, AIR-TO-AIR EFFECTIVENESS MODELING

R.A. Mercier, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141260)

Before substantial resources are invested in new technologies, there is the need to determine if the technology contributes to future Air Force capabilities. The Air Force has developed PACAM as air-to-air combat simulation model, to assess the utility of advanced fighter aircraft concepts. To date, this model has not been verified and has seen only limited use. The objectives of this effort are to verify PACAM and to use this model to evaluate the effectiveness of advanced fighter aircraft concepts.

This effort will be conducted in-house. AIMVAL-ACEVAL data gathered during Project Red Flag will be screened and reduced to provide baseline time histories for various air-to-air engagements. FXB will then run PACAM using the same starting conditions as the baseline cases. The results will be compared to identify required improvements in the model. All changes to the model will be coordinated with AFAL, ADTC/XR, and JTCG. After the model has been verified, it will be used to evaluate the effectiveness of advanced fighter aircraft concepts. Anticipated results from this portion of the effort include assessing design utility, identifying areas for improving the design, and identifying tactics development needs to effectively use these advanced concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, LAMINATED WING STRUCTURES

J.B. Monfort, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140090)

There is a continuing need to reduce costs and improve the structural efficiency of advanced military aircraft. Conventional design and construction techniques have been virtually pushed to their limits, with further improvements dependent almost entirely upon development of new alloys and material systems. The objective of this effort is to evaluate innovative design and fabrication techniques wherein additional system advantage can be achieved through laminating aluminum sheet by adhesive bonding to reduce acquisition and life cycle costs concurrently with weight savings and increased damage tolerance of primary airframe structure. The combination of economic and performance benefits realizable from improved airframes will provide the Air Force with a valuable tool for accomplishing the assigned mission with critical resources.

The Air Force Flight Dynamics Laboratory and the Air Force Materials Laboratory are jointly sponsoring contract F33615-75-C-5178 with General Dynamics/Fort Worth, MASIS Accession Number 678180, to design, fabricate and evaluate an adhesively bonded, laminated aluminum stub wing box based on the F-16 design criteria. As an integral part of this program three such wing boxes will be tested by the AFFDL, with non-destructive evaluation support from AFML, at Wright-Patterson AFB for static strength, fatigue and damage tolerance. All data and the wing boxes shall be returned to the contractor for analysis and inclusion of results in their final technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, CONTROL SYSTEM INDUCED AEROELASTIC INSTABILITIES

T.E. Noll, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF134660)

Aircraft with active control systems can encounter instabilities which result from the interaction of the control system with the aeroelastic response if adequate control compensation is not provided. The objective of this effort is to substantiate analyses which account for the control system interaction. This effort will establish the confidence and reliability of AFFDL in-house analysis procedures. The ultimate payoff will be a reliable method for use in the design stage for predicting and preventing control induced aeroelastic instabilities thus reducing cost and increasing flight safety for a new aircraft.

Frequency and time domain computer programs developed under AFFDL contract F33615-73-C-3063 will be applied to an advanced fighter aircraft with an active control system to predict control induced aeroelastic instabilities. These analyses will involve the interaction of the structural response, the airloads, and the control system response. A final technical report will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0029, COMBINED ENVIRONMENTS RELIABILITY TEST

H.E. Reynolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136650)

Repair costs of Air Force aircraft electronics equipment attributable to environmentally induced failures have been found to be approximately 460 million dollars per year. Equipments typically fail in service six to eight times more often than expected from laboratory demonstrations. The objective of this effort is to develop a realistic but cost-effective combined environments test that could be used for both qualification and reliability test and evaluation. The use of this test in the development and acquisition of electronics equipment should significantly improve its field reliability and correlation between field and laboratory reliability.

Realistic assessment of and prediction of actual environmental conditions that equipment is subjected to in field service will be determined through acquisition and analysis of aircraft environmental data. Realistic combined environment profiles will be developed for evaluation and test of aircraft equipment for various classes of aircraft. Capability to 'fly the equipment in the laboratory' will be developed by combined environment testing under realistic temperature, airflow, humidity, altitude, and random vibration conditions representative of aircraft equipment installations. New testing standards will be generated to provide the tests required to increase the effectiveness of testing needed to assure that only reliable hardware is introduced into service.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, DEFINE THE LOADING ENVIRONMENT OF AEROSPACE VEHICLES FOR THE DEVELOPMENT OF DESIGN CRITERIA

E.W. Turner, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B.*, Dayton, *Ohio* 45433 (DF131870)

One broad problem which the USAF must address is the design and fabrication of aerospace vehicles which have both high reliability and low life-cycle cost. Achieving these mutually conflicting goals requires a detailed knowledge of the loading environment to be used in developing valid design criteria, and advanced methods for computing the response of aerospace vehicles to this environment. The objective of this effort is to extend the present knowledge of the loading environment by acquiring and analyzing flight data, and developing techniques for computing the response of aerospace vehicles to the environment. This will lead to higher reliability and lower life cycle costs of aerospace vehicles.

A large collection of gust data is available from the previous critical atmospheric turbulence (CAT) recording programs. The aircraft structural integrity program (ASIP) is the primary source of operational flight loads data. Complementary data will be obtained from other recording programs conducted both by government agencies (including the AFFDL), and nongovernment agencies. The AFFDL recording programs will be conducted by installing special sensing and recording devices on both manned and unmanned flight vehicles, and flight simulators. Flight recorders will be developed when necessary to fulfill the future requirements of AFFDL recorder programs. Current data processing techniques will be used to reduce the data, and new techniques will be developed when existing techniques are inadequate. New methods will be investigated, and computer programs implemented to compute the response of aerospace vehicles to the gust and maneuver loading environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, STRESS MEASUREMENT IN PARACHUTE CANOPIES UNDER BIAXIAL LOADING

H.G. Heinrich, University of Dayton, Graduate School, 300 College Park Ave., *Dayton, Ohio* 45469 (DF142080; F33615-76-C-3145)

Current design practices for textile type canopies used in parachute recovery systems incorporate significant safety factors to account for the stresses resulting from dynamic loadings during the parachute opening process. As a result, perachute canopies are excessively heavy and bulky due to the required materials strength. The objective of this program is the development of a direct stress measurement technique for acquiring biaxial stress data on parachute canopies. The data acquired and engineering tool developed will contribute to the design of lighter and more reliable parachute recovery subsystems for AF weapons systems.

Model parachute canopies shall be instrumented with Omega stress transducers and the circumferential and radial stresses shall be measured during wind tunnel tests. Measured values shall be compared with the values calculated by existing parachute stress analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, A STUDY OF THE AERODYNAMIC INTERACTIONS OF THE TAIL ROTOR AND FIN 15710-E

P.F. Sheridan, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0F9244; DAAG29-78-C-0021)

To conduct a study of wind tunnel model test data to gain an understanding of fin-tail rotor aerodynamic interactions, to identify the gaps in understanding the physical mechanisms at work, and to establish a basis for further analytical and test programs. Relevance -the investigation seeks to study and understand aerodynamic interactions between tail rotors and fins which have caused problems in vibration, performance and flying qualities and is therefore directly relevant to improving helicopter directional control techniques.

A study of all the relevant data acquired by Boeing-Vertol will be carried out and will include both fin and tail rotor forces and moments in both dimensional and non-dimensional forms. Flow visualization records will be examined in relation to the trends of the plotted data and correlative studies will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0033, DEVELOPMENT OF FLIGHT CONTROL SYSTEMS/FLYING QUALITIES CRITERIA FOR LIFT/CRUISE FAN V/STOL AIRCRAFT

C. Abrams, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881124; N62269-77-C-0163)

To develop the criteria and specifications for an advanced flight propulsion control system and suitable pilot displays for a Navy multimission lift cruise fan aircraft. This effort is supported by work unit DH820B.

Investigations will be conducted to define flight control requirements for a lift cruise fan vehicle. Flying qualities criteria will be established for the design of a flight control display system suitable for all modes of flight including hover maneuvering, transition maneuvering, cruise maneuvering, take off and landing. The flight control development will address intergrated propulsive and aerodynamic control concepts, failure mode effects, pilot station controls and display actuation concepts and system reliability. The ability of the flight control display system to provide satisfactory flying qualities will be demonstrated through piloted simulation at the NASA Ames Research Center.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0034, HEAVY-LIFT AIRSHIPS TECHNOLOGY SUPPORT

J.A. Eney, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN581478)

To explore and develop candidate heavy lift air vehicles pursuant to operational requirement OR 1019 SL.

Two vehicle concepts are under consideration, the 'rotor-balloon' with a rigid rotor affixed to an aerostat centerbody, and the 'quad-rotor' with four articulated rotors flanking an ellipsoidal hull. Both concepts are being carried through model testing and simulation phases. A preferred configuration, when determined, will be prototyped and flight tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0035, NAVY STRUCTURAL FRACTURE CONTROL AND SERVICE LIFE MANAGEMENT PROGRAM

S.L. Huang, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN781434)

The objectives of this program are to augment the specifications for designing and accepting naval aircraft structures which will have a high degree of reliability and damage tolerance, and to formulate a new service life management system based on the existence of initial flaws and the technology for determining their rate of growth and the residual strength of structures in which they occur. Fracture mechanics concepts and NDI techniques will be used to quantify inherent and service induced damage and to evaluate their effect on structural behavior.

In order to achieve the stated objective of developing highly reliable fracture resistant air vehicle structures, new design and test specifications will be developed and implemented to insure structural integrity for current and future naval aircraft. A basic philosophical difference exists between this approach and the current procedure in that it is based upon the existence of initial flaws in the structure. The knowledge of the location, size and distribution of these flaws, inherent or induced during manufacture, is the starting point.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0036, ROTOR BLADE DYNAMIC RESPONSE AND BALLISTIC DAMAGE SURVIVABILITY

H. Zinberg, Bell Helicopter Co., *P.O. Box 482, Fort Worth, Texas* 76101 (DA0D4018; DAAJ02-75-C-0049)

To develop analytical techniques and modeling methods that will evaluate rotor blade survivability when subjected to ballistic damage in flight. The method shall be capable of evaluating composite and metal constructed main rotor blades for ballistic impacts up to and including 23mm HEI. The boundary conditions for structural stability and the flight regime necessary for 30 minutes safe flight after impact shall be established.

New computer programs will be generated or existing programs modified to account for reduced blade stiffness resulting from ballistic damage. Input data for programs will be blade section properties, location, impact energy and amount of material removed as a result of damage. Program will calculate blade residual strength, blade dynamic properties, and coupled rotor airframe dynamic properties. Static and dynamic tests will be performed on damaged blades and/or blade sections to verify analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0037, EXPERIMENTAL D-OPTIMAL DESIGN METHOD IN OPTIMAL AIRCRAFT DESIGN

J.A. Craig, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF141310; F33615-78-C-3011)

Computer aided aircraft designs are being increasingly applied for optimized aircraft designs. A significant problem area in computer aided aircraft designs is the selection of an optimal set of design vectors which are necessary for determining a quadratic regression for the aircraft performance parameters. A computer code for generating D-optimal designs, if accomplished, will exactly do the optimal screening of the design vectors, and the effectiveness, from the cost-savings point of view, of the D-optimal designs will be significant. Accuracy and reliability of the proposed work effort (i.e. computerizing the D-optimal design method) will enhance optimal aircraft designs for the Air Force missions.

The approach will be based on minimizing the variance of the response functions as well as by requiring that the variance of the coefficients of the quadratic regression be minimum too.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0038, HT RM 78-17 - DEVELOPMENT OF ADVANCED STRUCTURES MAINTENANCE CONCEPTS

T.E. Condon, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3814)

Development of maintenance concepts based on advanced structures concepts proposed or under development for application to Army helicopters of the 1980s.

Investigate and evaluate maintenance concepts applicable to advanced structures concepts. Additionally develop test and evaluation techniques applicable to the advanced structures concepts. An integral part of this program will be the development of field repair techniques and kits.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0039, HT RM 78-20 - ENVIRONMENTAL DESIGN AND TEST GUIDE FOR ARMY HELICOPTERS

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3828)

The objective of this effort will be to develop an environmental design and test guide for Army helicopters based on the previous work performed by Rockwell International. The guide will be used to assist Army planners in the establishment of design and test criteria for future Army aircraft programs. This document will also be used by industry personnel to assist them in the design and test of their vehicles to meet environmental requirements.

Using the services of the Earth Sciences Laboratory, Fort Belvoir, VA, the combined and accelerated environmental design and test criteria and procedures will be developed where practical or a method developed to establish those criteria and procedures when it is not practical to establish generalized criteria and/or procedures. The previous work by Rockwell and this work will then be combined and a design and test guide prepared.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0040, DYNAMIC RESPONSE OF COMPOSITE STRUCTURES TO NONNUCLEAR THREATS

J.G. Avery, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137670; F33615-78-C-3403)

With increased usage of advanced composites as structural materials in aircraft components, the effect of threat induced damage in a combat environment becomes increasingly important. Aircraft structural designs using composite materials tend to present some unique problems which need to be further explored. The objective of this program is to investigate the effects of nonnuclear threat mechanisms on aircraft structures fabricated from composite materials. As the result of this effort, the effects of threat damage mechanisms on composite structures will be understood and will provide a data base for the development of survivable composite structure design criteria and guides.

To be investigated is the damage that results from the interaction of nonnuclear threat mechanisms with composite structures and the effects that such damage has on the strength of the composite structures. Factors associated with the investigation will be threat types and the damage mechanism associated with each type of threat, various types of composite materials and structural concepts, the application of the various composite structural concepts, the damage produced by the various threat mechanisms and the effects on the strength of the structural composites produced by the damage. Data voids will be identified and test plans developed to fill these voids.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0041, EXTENSION OF FLEXSTAB FOR ANALYSIS ACCURACY AND EFFICIENCY

J. Dornfeld, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF138870; F33615-76-C-3170)

This work unit supports TPO 3, flight control, and major thrust FG02B, flight control system design techniques. Specifically this work unit will identify errors or inefficiencies in, and add capabilities to, level 3.01.00 FLEXSTAB computer program systems. The objectives of this work unit are to (a) modify FLEXSTAB to allow the aeroelastic analysis of cantilevered, flexible wind tunnel models, (b) modify FLEXSTAB to include Kussner-Wagner indicial lift growth functions for increased accuracy when analyzing higher frequency modes and gust aerodynamics, modify FLEXSTAB to optionally allow a linear time response capability in addition to the current nonlinear time history analysis capability, (c) improve the accuracy of the hinge moment calculation, (d) modify FLEXSTAB to more efficiently handle, store, and operate upon matrices in order to effect a 50 percent - 80 percent cost savings for matrix operations, (e) correct all known and newly discovered errors in the FLEXSTAB coding and documentation. When this work unit is completed all errors and inefficiencies in level 3.01 FLEXSTAB CPS and documentation will either be corrected (money permitting) or identified in detail for later correction.

This work will consist of analytical and experimental studies to determine the best methods to modify FLEXSTAB to produce a more accurate and cost-effective prediction method. The approach is to (1) formulate dynamic load equations based on level 2.01.00 perturbation output, (2) incorporate these equations into the control-free analysis programs, (3) determine limits of applicability, (4) recommend other in-house and contracted efforts, (5) provide additional support. Reports will be prepared during the course of this effort to document significant accomplishments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0042, MICROSTRUCTURAL CHANGES FOLLOWING SUPERPLASTIC DEFORMATION OF TI-6AL-4V

A. Rosen, Technion, *Haifa, Israel* (DF289520; AFOSR-77-3441)

AF function - research in improved and lower cost air frame components. Deficiency - present methods for the fabrication of titanium components result in high cost. Furthermore, little is known of the post forming response of superplastically shaped titanium, a low cost approach. How research contributes - it is expected to find answers to the following questions - (1) What is the effect of temperature on the mechanism of superplastic deformation? It is well known that the volume fraction of beta is strongly temperature dependent, and therefore, the change of the alpha/beta ratio may influence the deformation mechanism. (2) If superplastic deformation is controlled by grain boundary sliding, what is the role of the alpha-alpha, beta-beta and alpha-beta grain boundaries? (3) What is the mechanism which eliminates void formation during grain boundary sliding? (4) Is there any change of structure due to superplastic deformation? (5) What is the role of plastic deformation on grain growth?

The aim of the proposed research is to understand the mechanism of superplastic deformation of Ti-6Al-4V by means of direct observation of the structure in the transmission electron microscope. Direct observation of the microstructure and the structural changes which take place during superplastic deformation is not feasible due to lack of appropriate equipment. Instead, this approach is to freeze - in the high temperature structure which develops during superplastic forming - and to compare it with the structure which develops under similar conditions, but without application of stress. Tensile testing will be carried out in vacuum at various temperatures and strain rates in a specially designed apparatus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, SULFUR IN THE CORROSION OF SUPERALLOYS 14925-MS

J.B. Wagner, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DA0F9141; DAAG29-78-G-0032)

Investigate high temperature degradation of metals in sulfur-containing gases, to contribute to an understanding of the transport of sulfur through oxides and to determine the role of surface finish and subsequent protectiveness to oxide films formed in SO sub 2-O sub 2 gas mixtures. Relevance - the research is relevant to the hot corrosion of turbine components and to the Army program to develop improved hot corrosion resistant coatings for high temperature alloys.

Oxidation of pure nickel and cobalt in SO sub 2-O sub 2 gas mixtures, with particular attention directed at the role of oxide morphology and metal surface preparation on the subsequent structure of the corrosion product. Radiotracer diffusion of sulfur-35 in cobaltous oxide single crystals to determine whether anomolous penetration profiles as seen on nickel surfaces is a general phenomena.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0002, A STUDY OF MATERIALS PHENOMENA AND LOW-TEMPERATURE PROCESSES

R.A. Armistead, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DF051030; F49620-78-C-0010)

AF function - the proposed research primarily falls in the 2.3 research objectives which deal with developing superconducting materials with higher transition temperatures, higher upper critical magnetic fields, lower AC losses and higher current carrying capabilities. Deficiency - new approaches to Air Force power generation and distribution and remote sensing and detection of electromagnetic radiation depend upon new and improved superconducting materials. Josephson junction devices are needed for ultrasensitive detectors of electromagnetic radiation especially in the ranges of 1-100 microns and 10-6 to 10-5 Gauss. Objective - the subject concerns nonequilibrium processes and Josephson tunneling in superconducting films. Contribution - this research is a part of a program in low temperature physics.

The studies in the Josephson tunneling I-V characteristics of superconductors in nonequilibrium state will be conducted in crossed film, superconductor/oxide/superconductor junctions. The crossed film junctions will be fabricated by thermal evaporation of Sn. A slow oxidation, and a second thermal evaporation of the second Sn electrode will form a complete Sn-SnO-Sn junction. These films make reliable junctions with easily attainable transition temperatures (37 degrees K). they are also useful for forming the first electrode and insulating layer of junctions using another material, for example, Pb or In, for the second superconducting electrode. Such systems allow the study of superconducting energy gaps from quite-different, more strongly coupled, superconducting materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, ENVIRONMENTAL DURABILITY OF FIBER-REINFORCED COMPOSITES 14414-MS

D.H. Kaelble, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DA0E9297; DAAG29 77 C 0005)

To determine the physicochemical mechanisms of environmental durability and degradation of graphite-epoxy and fiberglass-epoxy composites under hydrothermal (high moisture and temperature) exposure. Relevance - the research is directly relevant to the degradation of the structure and properties of epoxy matrix composites, which are being used (or considered for use) in many Army components, e.g., aircraft, portable bridges, missile launch tubes and motor cases, tank wheels.

Determine the effects of moisture and temperature on the composition and bonding of the fiber-matrix interface; evaluate loss of bonding at the fiber-matrix interface by measurement of interlaminar shear strength; and determine the effects of moisture and temperature upon the bulk properties of the matrix epoxy, e.g., composition, adhesive aspects, and rheology.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, CHEMICAL PHYSICS OF CHARGE MECHANISMS IN NONMETALLIC SPACECRAFT MATERIALS

J.E. Nanevicz, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF048670; F49620-77-C-0113)

AF function - operational and future Air Force space systems are required to perform their missions in extreme service environments. Deficiency - the interaction of a synchronous-orbit satellite with its environment activates electrification and electrical discharge processes producing electromagnetic noise pulses and effluents which deteriorate satellite materials, surfaces and components. Objective - the objective is to perform research to understand the mechanisms underlying spacecraft charging in polymeric and other nonmetallic dielectrics. How work contributes - it is expected that this research will contribute to the establishment of guidelines for the design and modification of satellite materials which are not degraded by the effects of electrical charging and which will minimize disruptions in Air Force space systems mission performance.

(a) Study nature, causes and effects of charging and discharging processes in typical spacecraft polymers and other non-metallic dielectrics under orbital conditions, (b) deter physics of critical electrostatic charging phenomena and properties of materials that affect electrostatic charging properties, and (c) study methods for modification of materials properties to improve their in-space performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, LABORATORY MEASUREMENTS OF PHOTOLYTIC PARAMETERS OZONE (O3)
Unknown, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (FA78WA-4263; FA161583 (TRAIS NO.))

The contractor will measure the absorption cross-section and quantum yields of all product branches on the photolysis and ozone (O3) as a function of temperature (between 200 and 300 K) and wavelength range. The experimental approach will be based on 1) a neodymium-YAG pumped doubled dye laser which shall be used as a photolysis source; 2) a multichannel analyzer system which will be used to monitor the O(1D) emission at 630NM and the O(3P) resonance fluorescence at 130.5 NM; 3) the temporal behavior; and 4) the absorption coefficients for ozone from 270 to 350 NM over a temperature range of 200-300 K which will be determined in a long path absorption cell.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0006, FILM SYNTHESIS AND NEW SUPERCONDUCTORS
T.H. Geballe, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DF050440; F49620-78-C-0009)

AF function - high temperature superconducting materials are needed for application in airborne multi-megawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the research studies fundamental mechanisms which give rise to superconductivity, explores the occurrence of superconductivity in compounds and composites, synthesizes films with optimal superconducting transition temperatures, and seeks a model for predicting high temperature (above 23 degrees K) superconducting state in metastable metallic phases. How work contributies - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced.

Metastable phase equilibria at lower temperatures are being studied by utilizing the unique capability of the electron-beam codeposition apparatus to lay down intimate mixtures of two or more components on a substrate whose temperature is subject to independent control. The high superconducting transition temperature A-15 phases are being investigated. Particular attention is given to Nb3Ge, Nb3Si, and ternary compounds derived from them. The superconducting properties are being correlated with the new phases using sensitive thermal and electrical techniques as well as crystallographic and metallurgical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, FUNDAMENTAL APPROACH TO PROBLEMS IN CERAMIC ENGINEERING
D.M. Esterling, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DF046050; AFOSR-77-3114)

This proposed research primarily falls in the 2.1 research objectives which deal with failure processes. Basic research to identify new families of ceramic materials capable of economical consolidation to densities approaching 100 percent and possessing improved creep and thermal fatigue resistance is needed for extending limits of future generation expendable and recoverable high temperature turbine engine components. A rational basis for the development of alloys, nonmetallic materials, ceramics, and composites which are stronger is needed for all Air Force systems. Deficiency - failure processes such as fatigue, fracture, and creep are in most cases intimately related to the microstructures of alloys, polymers, ceramics, and composites. Understanding of these processes and properties mechanisms must be integrated with appropriate constitutive equations and appropriate failure criteria. Considerable progress can be achieved in structural reliability and integrity as a result of some basic studies. Objective - the objective of this research is to study the microstructure responsible for the mechanical properties of materials on an atomic scale. The areas to be investigated include the structure and energy of large angle grain boundaries, impurity-dislocation interactions and crack-grain boundary interactions. Contributions - this research is a part of a comprehensive program to use statistical mechanics on real systems.

An alternative approach to problems in ceramic engineering is proposed, exploiting the constructs and methodology of solid state physics. The analysis will be taken one level beyond the microstructure investigating atomic processes and their role in determining the microstructure. It is proposed to computer simulate crack tips, dislocation cores, and grain boundaries within a lattice (as compared to continuum) model employing realistic potentials. The present lattice model which is based on a variation of the lattice statics method will be improved. The potentials will be derived using recently developed techniques in quantum chemistry as well as the more established pseudopotential method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, ORIGIN OF N-ALKANES IN JET FUELS DERIVED FROM SHALE OIL, COAL AND TAR SANDS
R.N. Hazlett, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880122)

The purpose of this research is to determine how N-alkanes in the jet fuel range are formed in the thermal processes used to produce liquid fuels from shale oil, coal and tar sands. A further objective is to suggest variations of thermal processes or refining procedures which will result in a lower concentration of N-alkanes, thus relieving the jet fuel freezing point problem.

The original resource material will be analyzed to define the potential for N-alkane formation. Then thermal processes such as retorting, pyrolysis and delayed coking will be examined by varying system parameters such as temperature, pressure and time.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, RELATIONSHIP BETWEEN MICROSTRUCTURE AND MECHANICAL PROPERTIES OF INTERMETALLICS
J.J. Hren, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF047770; AFOSR-77-3254)

AF function - requirements for gas turbine engines include strong, lightweight, oxidation resistant materials for high temperature operation. A need exists for materials to operate at higher engine temperatures (to improve operating efficiency), and for lighter weight materials (to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption). The needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel base superalloy. Opportunity -intermetallic compounds in general, and the titanium aluminides in particular, have exhibited great potential for such applications. Unfortunately, nearly all intermetallic compounds are brittle at low temperatures, making their fabrication difficult and presenting potential hazards in service. However, recent reports indicate that some alloying additions can substantially improve low temperature ductility. Objective - this research will determine the intrinsic mechanisms of deformation and the available means for their control in a wide class of intermetallic compounds. How work contributes - initially, the investigation will be directed towards clarifying the source of improved ductility in the titanium aluminides.

The research will involve fabrication, testing, and detailed microstructural analysis of a range of alloys. Prime goals will be to

deduce the microstructural sources of these beneficial effects and to discover guidelines for more general application. The strength of these studies is founded on the use of advanced electron metallographic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, NAVY ENVIRONMENT - STUDIES OF DELAYED FRACTURE MECHANISMS IN ALUMINUM ALLOYS USED IN NAVAL AIRCRAFT AND BOAT STRUCTURES

J.A. Green, Martin Marietta Corp., *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN723866; N00014-74-C-0277)

The investigators seek to determine the causes and mechanisms responsible for delayed failure in many strength aluminum alloys used in naval structures when stressed in the marine environment.

The effect of microstructural and compositional variations on a macro- and micro-scale on the delayed fracture behavior of Al-Zn-Mg alloys is being studied. Structure and compositional variations are achieved by heat treatment and characterized by standard metallurgical techniques. Tensile fracture tests are conducted in various environments and fracture characteristics are correlated with structure and composition. A description of the mechanisms of delayed fracture in terms of variations in material, stress and enviroemental conditions is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0011, MATERIALS SUPPORT TECHNOLOGY - PHOTO AND IMPURITY EFFECTS IN AMORPHOUS COVALENT SYSTEMS AND FORMATION OF AMORPHOUS METALLIC ALLOYS

D. Turnbull, Harvard University, Cambridge Campus, Div. of Engineering & Applied Physics, *Cambridge, Massachusetts* 02138 (DN775040; N00014-77-C-0002)

Some amorphous metals have been shown to possess unusual physical or mechanical properties suggesting possible Navy use in soft magnet applications, photosensitive materials, high strength reinforcements, magnetic bubble materials, etc. This effort will investigate several factors which may affect the structure and properties of these interesting materials.

This program will explore the photosensitive nature of A-As2Se3 and A-As2S3 and compare the results to A-Se, which was previously shown to crystallize as a result of photoillumination. Factors affecting retention of the amorphous state in metals will be determined. Of special interest are compositional and thermal effects on formation and crystallization of these glassy metals. Accordingly diffusivity and viscosity behavior below TG will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, MATERIAL SUPPORT TECHNOLOGY - GRAPHITE INTERCALATION COMPOUNDS

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Intercalated graphite compounds have exhibited high conductivities. Research has been directed towards achieving conductivity equal to or greater than that for copper. Many naval systems could benefit from a light, strong metallic fiber. The objective of this program is to determine the electronic structure of these compounds in order to correlate the electrical behavior with their atomic structure and composition, with the view to being able to design better conductors.

Metallic graphite intercalation compounds are studied by Raman and infrared spectroscopic techniques to determine those lattice modes which can be identified with vibrations of the carbon atoms in the graphitic layers and other modes specific to each intercalate species. These results are combined with theoretical studies to determine the electronic structure of the compound when graphitic and intercalate layers are brought together to their equilibrium separation in the intercalation compound. Both acceptor and donor intercalation compounds are studied and special attention is given to the symmetry properties of the Raman and infrared spectra to provide information on the inplane ordering of the intercalate layer planes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, PREPARATION AND CHARACTERIZATION OF INFRARED MATERIALS

A.F. Witt, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046960; AFOSR-77-3202)

AF function - aerospace communications surveillance and detection systems require electro-optical devices which exploit the special properties and interactions of infrared radiation with solid state materials. Opportunity - infrared materials research has high potential for airborne and satellite applications. Sophisticated electro-optical techniques and characteristics of narrow band-gap compound semiconductors offer promise for electro-optical microcircuitry in the spectral range 10 to 100 micrometers. Objective - the aim of this research is to optimize compositional homogeneity and to control compositional variations in III-V and II-VI semiconductor compounds. The goal is to establish quantitative relationships between growth parameters and materials characteristics and to utilize the special properties of these materials for electro-optical device concepts and components. How work contributes - infrared detectors and tunable infrared sources of coherent radiation require solid state materials with narrow band gaps, controlled carrier concentrations and doping to provide optimal performance characteristics for sensing and for communicating in an aerospace environment.

To obtain infrared materials with the specified compositional control requires basic modifications of conventional crystal growth systems. For the growth of intrinsic InSb the hot-zone of a Czochralski system is to be modified through the installation of a coaxial sodium heat-pipe. InSb with modulated carrier concentration is to be obtained by appropriate N-type current pulsing during rotational and/or non-rotational pulling. Heavily doped (Bi, Tl) InSb is to be grown in a modified Bridgman-Stockbarger system in which the onset of constitutional supercooling is delayed by means of differentially operated heat-pipes which permit the establishment of maximized thermal gradients across the growth interface. All materials grown are to be quantitatively characterized for compositional distribution, crystalline perfection and for potential application as infrared detectors or sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, ELECTROPLATING ON TITANIUM

C. Levy, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4813)

The objective is to develop a method for applying adherent electrodeposits on titanium alloys.

Alloy composition electrodeposits will be plated followed by low temperature diffusion treatments of less than 1100 degrees F. Adhesion will be evaluated by metallographic examination and ASTM methods.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0015, DEVELOPMENT OF NEW FIRE RESISTANT POLYMERS

R.E. Singler, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0D4697)

To develop high-strength, chemically resistant, thermally stable polymers with a phosphorus-nitrogen backbone which will be evaluated for use in nonflammable coatings, foams and insulation, hydraulic fluids, and other applications. Major thrust - survivability, night operations, aircraft and combat vehicles.

Exploratory synthesis will be continued in the area of poly (aryloxy and aminophosphazene) copolymers. Chemical modifications will be studied in attempts to prepare phosphazene terpolymers, suitable for cross-linking, and cyclolinear polyphosphazenes. These polymers will be investigated for both closed-cell and open-cell foam applications. Polymerization conditions will be manipulated in order to prepare phosphazene oligomers as fire resistant hydraulic fluids. The thermal mechanical behavior and morphology of these polymers will be investigated to determine structure-porperty relationships for the polyphosphazenes. The large scale laboratory synthetic effort will be continued to provide sufficient quantities of polymers for laboratory processing studies and long term environmental deterioration studies.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0016, RECYCLING EXISTING PAVEMENT MATERIALS FOR PAVEMENT REHABILITATION

T.D. White, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0Z8026)

Current construction state of the art includes recycling processes for asphalt pavements. Recycling asphalt pavement can provide economic, logistic, environmental, and technical benefits. However, there is a lack of definitive criteria that would take advantage of functional properties of the recycled material. It is proposed that a study be initiated to develop design and construction criteria for recycling asphalt concrete. This objective would best be accomplished by a laboratory study of pertinent material and mechanical properties. Test data from this study would form a data base from which to generate criteria and means of evaluating the capability and performance of recycled asphalt paving materials.

The intent of this study is to develop criteria for re-use of existing asphalt concrete airfield pavements. The study will encompass a review of procedures for breaking up and re-using embrittled asphalt, laboratory tests on recycled mixtures, establishment of quality provisions for recycled mixtures, and preparation of a technical report containing criteria recommendations.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

3.0017, WEAPONRY - PROCESSES AFFECTING COMBUSTION OF SOLID PROPELLANTS

L. Caveny, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DN623049; N00014-75-C-0705)

The Navy missile arsenal contains a wide variety of solid propellant rockets, and it is the objective of this task to advance the understanding of performance behaviors of solid propellants, and thereby lay the scientific groundwork for solid propellant rocket developments of the future. The main emphasis here is on solid propellant combustion embracing the description and incorporation into theoretical scheme all processes, physical and chemical, which occur during the burning of a solid propellant. The fundamental studies of this task form the bases for selection of propellant ingredients and physical design of the solid propellant grain which may be used in Navy ordnance rockets, as well as in solid propellant rockets for any application.

The pressure dependence of the burning rate of RDX and RDX composite propellants will be studied emphasizing the kinetics of RDX decomposition and the rates of reaction of the decomposition products. These rate data will be used in models of the burning process that include reaction, momentum, energy, and mass transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0018, SOLID ELECTRODE STUDIES RELATED TO CORROSION PREVENTION, FUEL CELLS AND BATTERIES

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AF function - Air Force operational environment's power generation is relied on through electrochemical power sources, such as batteries and fuel cells. Deficiency - the detrimental effects of corrosion on AF equipment is also involved with electrochemical reactions. Objective -research involves the study of solid electrode surfaces processes, and the phenomena that influence these processes. How work contributes -results will give a better understanding of the adsorption and formation of products on the surface of the electrodes, as well as the potential corrosion sites.

Emphasis of this research will involve 'underpotential' metal deposition. It deals with an adsorption of a metal ion with some charge transfer at a potential more anodic than the equilibrium potential of the ion in contact with its reduced form in the metallic state. The exact description of these adsorbed species on the electrode surface is to be determined. Sinusoidal hydrodynamic modulation (SHM) and small signal A.C. techniques will be employed in the underpotential adsorption studies. The principal experimental technique will involve the rotating ring-disk to separate out the partial currents for alloy dissolution from the cathodic process leading to the mixed potential.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, EFFECT OF BONDING CHARACTERISTICS ON METAL MATRIX COMPOSITE PROPERTIES

R.G. Carlson, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF047990; F49620-77-C-0067)

AF function - Air Force propulsion systems of the future are expected to contain metal matrix composites because of their attractive mechanical properties at substantially reduced weight. Opportunity -however, a better technical understanding is required for design and application of this class of materials. In addition, this understanding is anticipated to provide for improved impact resistant materials for fan and compressor blades, and to allow for lower cost processing and fabrication of metal matrix composites. Objective - this research will develop an understanding of the metal matrix composites to effect a balanced increase in mechanical properties, placing specific emphasis on increased impact resistance. How work contributes - this technology can then be translated into composite systems in general, including resin matrix composites, and lead to more extensive application of composite materials to aircraft propulsion systems.

This program is directed toward understanding the basic bonding mechanisms of metal matrix composites, specifically between boron filaments and an aluminum matrix. The effort consists of three tasks -(1) surface preparation and characterization of single sandwich panels incorporating both aluminum and boron surface treatments, (2) upon extraction of correlative data, larger 8-ply panels will be selected and fabricated, and scrutinized by nondestructive evaluation, (3) the larger panels will be sectioned, and selected mechanical and physical properties will be evaluated in order to ascertain generic coupling/property behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, MATERIALS SUPPORT TECHNOLOGY - ADVANCED OPTICAL CERAMICS

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A limiting area for many weapons systems (present and planned) is performance of solid transmitting window materials needed for their operation. Such systems include missiles, RPV's, spacecraft and lasers. These materials must exhibit acceptable transmission characteristics during operation and must also have acceptable resistance to aerodynamic heating, other thermal

strewing, rain and dust erosion, shock, etc. This task is aimed at quantification of severity of performance requirements for electromagnetic solid window materials to give additional direction to materials development activities.

Required performance characteristics, improvement in them, and hence, properties of window materials will be defined. Advanced systems performance goals will be related to window capabilities. State-of-the-art evaluations for materials properties, processing and finishing will be made. Relations between systems parameters and window performance will be assessed. A basis for establishing materials performance requirements and materials development work is to be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, IMPROVED MONOPROPELLANTS
P.L. Darby, U.S. Dept. of Defense, Navy, Naval Underwater Systems Center, *Newport, Rhode Island* 02840 (DN789051)

Development of high energy liquid monopropellants which are non-toxic relative to the nitrate ester type in current use, and which meet stringent safety requirements.

Since wakelessness is not an imposed requirement as was the case when solex monopropellants were conceived and developed, 'complete combustion' stoichiometry is not a restriction. Hence, a great deal more latitude would appear to be available for formulation. In the candidate selection of suitable choices, both the intramolecular type where the energy of decomposition resides in one molecule (a nitrate ester, for example - Ottofuel II) and the intermolecular type where useful propulsive energy is derived from the reaction between two chemical species (SOLEX-1 or SOLEX-2, for example) are approach options. SOLEX-1 monopropellant undergoes a thermal explosion at elevated temperatures (500 degrees F) due to the fact that the fuel component does not boil off prior to thermal decomposition of the perchloric acid. In order to eliminate this potential hazard (in the event of an accidental fire) fuel candidate selection will be largely concerned with behavior and characteristics at elevated temperatures; safety is an overriding objective.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0022, TURBULENT MIXING RESEARCH
P.T. Harsha, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420818; F40600-75-C-0001)

The objective of this experimental and analytical project is to develop reliable prediction techniques for high speed turbulent mixing processes, including those flows with exothermic chemical reactions.

Special emphasis is placed on mixing systems which are used in propulsion devices and ground testing facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

3.0023, VIBROTHERMOGRAPHY - INVESTIGATION OF A NEW NONDESTRUCTIVE EVALUATION TECHNIQUE 16282-MS
K.L. Reifsnider, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DA0G8959; DAAG29-79-G-0037)

To determine the mechanisms responsible for evolution of heat in mechanically loaded materials, especially in the neighborhood of materials defects, and to study limitations in techniques to detect the evolution of heat. Relevance - this research is relevant to the nondestructive evaluation of composite materials used in structures, penetrators, armor, helicopter and missile components, and to understanding of the mechanisms of fatigue failure in composite materials.

Isolation and characterization of the various processes known to generate heat in materials (plastic deformation, rubbing of mating surfaces, elastic hysteresis, release of strain energy, dispersion and attenuation of stress waves). Measurement of evolution of heat from a series of well-characterized flaws which are cyclically loaded. Modelling of the heat transfer from defects in solids. Comparison of theory with results on state-of-the-art manufactured materials.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0024, QUANTUM CHEMISTRY OF SMALL MOLECULES
E.R. Davidson, University of Washington, School of Arts & Sciences, Dept. of Chemistry, *Seattle, Washington* 98105 (CHE7684036A02)

Davidson will continue his work on potential surfaces and excited states, and begin research in theoretical X-ray photoelectron spectroscopy. Triatomic potential surfaces (especially for excited states) are of great practical interest because of work in plasmas, lasers, and atmospheric pollution. Theoretical calculations of the potential surfaces for several of the more interesting triatomics will aid in building experience in the types of topographic features which can be presented. The HCO radical is of great importance in flames, and calculations of its quite complex excited-state potential surfaces will be undertaken. Similar studies are planned for other triatomic radicals such as HNO, CH2, etc., of importance in hydrocarbon fuel combustion in air. X-ray photoelectron spectroscopy is an important experimental tool in studies of the electronic structure of molecules, but interpretations of the spectra still leave many unanswered questions. Studies are underway on the X-ray extended fine structure of Br2, C12, and F2, and on the satellite structure of ethylene. Projects to be initiated under this grant include application of discrete basis function methods to calculations of intensities of primary spectral peaks associated with core-hole and valence hole states of neon, carbon monoxide, ethylene, and acetylene.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0025, SYNTHESIS AND SPECTROSCOPIC INVESTIGATION OF INORGANIC MATERIALS POSSESSING UNUSUAL ELECTRONIC PROPERTIES
G.A. Crosby, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF042400; AFOSR-76-2932)

AF function - advanced aircraft employ avionic and weapons systems with increased performance requirements. Deficiency - functional components for electromagnetic and electro-optical systems require materials with tailorable and predictable properties. Objective - the objective of this research is to utilize transition metal complexes and their charge-transfer excited states in solids to guide the design of new electronic materials. How work contributes - highly specialized materials could result in significant performance improvement in Air Force electronic displays, non-linear optics, electro-optical devices, and laser systems.

The research encompasses chemical synthesis, optical absorption, emission and reflectance measurements, and the determination of the effects of external magnetic fields on excited solid state properties of complementary inorganic complexes whose electronic structures suggest the incidence of strong solid-state interactions where the units are incorporated with solids. These include complexes of d-6, d-8 and d-10 ions from all the transition series with emphasis on those whose low-lying excited states are charge transfer in nature and those with high electronic affinities. Special emphasis is placed on mixed-ligand materials and sulfur coordination. There will be increased emphasis on measurements at low temperatures as the role of isolated systems in solid state interactions become defined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, SURVEILLANCE - PRIMARY PHOTOPROCESSES
M.W. Windsor, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DN223328; N00014-75-C-0535)

Tunable lasers and, in particular, dye lasers are of considerable interest to the Navy for application in communication systems, in systems for underwater photography and in systems for rescuing downed naval aviators. Limited accessibility for servicing and restrictions on available space place a high premium on reliability and the overall electrical efficiency of such systems. It is the purpose of this research to find and to study short-lived, light absorbing species in dye lasers. The data obtained will be used to recommend changes in the molecular structure of the dyes that will lead to improved laser reliability and efficiency.

The short-time photophysics of triphenylmethane dyes will be studied. Work will also be carried out to determine products of dye degradation in a blue-green dye laser.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0027, MEASUREMENT OF THERMAL DIFFUSIVITY OF CARBON/CARBON FIBER COMPOSITES FROM 20 - 3000 DEGREES C

R. Taylor, University of Manchester, *Oxford Rd., Manchester, England, United Kingdom* (DF050060; AFOSR-77-3449)

AF function - weapon delivery. Deficiency - in order to design, develop and evaluate carbon/carbon composites for use in reentry vehicles and rockets, the transport properties must be determined to accurately refine the temperature field, and calculate the thermal response, within nosetips, heat shields, and rocket nozzles. Objective - in this research, detailed experimental data will be obtained and used to derive an analytical model which relates thermal diffusivity at temperatures up to 3300K to matrix properties, fiber volume and orientation, and pore structure of carbon/carbon composites. How work contributes - if a successful model is obtained, it will go a long way toward satisfying the noted deficiency. But in any case, the reliable thermal diffusivity data will in themselves be useful to AF technology.

Using the laser heating pulse method already developed at the University of Manchester, thermal diffusivity from ambient to 3300K will be measured for carbon/carbon composites of various geometries, fiber type and matrix properties. Samples, and all available information relative thereto, will be furnished by AFML. Additional characterization will be obtained by the contractor through metallography, electron microscopy and X-ray diffraction. Correlation of measured thermal diffusivities with structures and other properties, leading to semi-empirical heat transport models, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, NEW MATERIALS FOR ELECTROCHEMICAL CELLS

J.B. Goodenough, University of Oxford, *S. Parks Rd., Oxford, England, United Kingdom* (DF049570; AFOSR-77-3402)

AF function - propulsion and power generation systems for operational vehicles and devices rely on electrochemical power sources, such as batteries and fuel cells. Deficiency - need for solid electrolyte materials and for information on the preparation and characterization of ionic conducting materials. Objective - work will be directed to the improvement of solid electrolytes, and of mixed electronic/ionic conductors for use in electrochemical cells. How work contributes - results will yield a better understanding of the preparation and characterization of new ionic conductors, both electronic insulators for electrolytes and electronic conductors for battery cathodes, and display purposes.

Emphasis will be given to the determination of thermochemical, structural, electrochemical, and transport data on selected solids relevant to their potential use as battery cathodes, display cathodes, or solid electrolytes. Work will concentrate on full characterization of the insertion compounds to lithium which form cathodically from the oxides of molybdenum, vanadium and manganese. Electrochemical and standard thermodynamic functions will be measured for the reactions. Quantitative information on the mobility of the alkali-metal species in the parent oxide matrix will be obtained from pulsed NMR measurements. Design of new cathodic insertion systems with known skeleton and layer compounds that are good solid electrolytes will be initiated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LOW COST LAUNCHER TECHNOLOGY EVALUATION AND INTEGRATION

J. Prater, U.S. Dept. of Defense, Army, Missile Command, Ground Equipment & Materials Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1013)

The objectives of this task are A. Integration of low cost launcher technology into the free flight rocket technology program. B. determination of the effect low cost launcher technology has on mal-launch. C. Investigation of methods for eliminating blow-by in tip-off type launchers. D. Determination of mal-launch induced by blow-by elimination mechanisms.

Launchers using low cost technology will be designed and fabricated. Flight test will be performed using rocket motors developed under a low cost motor technology program. Optical lever and telemetry data will be used to determine rocket motions during launch. These data will be compared to data from earlier tasks to determine effect on launch accuracy.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0002, FLUIDIC TECHNOLOGY INVESTIGATIONS - FLUIDIC ACTUATION SYSTEM

D.A. Millett, Signal Co. Inc., AiResearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0G1007; DAAK40 77 C 0163)

The objective of this task is to develop an air vane actuator using low cost and reliable fluidic valving techniques.

An actuator will be designed, developed and tested to use a two stage fluidic valve. The first stage of the valve will be a pin amplifier which will drive a diaphragm to actuate a flexible jet pipe. Warm gas from a solid propellant generator will supply power for the actuator.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0003, ELECTROMAGNETIC PULSE (EMP) PROPAGATION IN AN ELECTRON CONDUCTION PLASMA

R.N. Carlile, University of Arizona, School of Engineering, Dept. of Electrical Engineering, *Tucson, Arizona* 85721 (DF042680; AFOSR-76-2949)

AF function - the EMP created during a nuclear detonation may adversely affect AF systems depending upon its direction and magnitude. The extent to which the plasma of the source region will interact and modify the EMP must be understood in order to harden aircraft effectively. Opportunity - the proposed research will aid in the understanding of the propagation of EMP through ionized media. Objective - this study will measure the energy absorption and heating of gaseous media by EMP when the media is immersed in a magnetic field. Contribution - a high gas pressure absorption that is much larger than that predicted by the swarm model has been measured experimentally and will be investigated further. Also, long time experimental energy emergence will be investigated further to find causes of the long time effects.

The absorption of energy from the EMP by the electron conduction plasma following a nuclear detonation will be studied in the presence of a superimposed magnetic field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, ELECTRONIC COMPONENTS FOR A/C PROPULSION CONTROLS

R.F. Potter, (No Performing Organization Reported), *California* (DN890085; N00019-78-M-0285)

A research study to examine and evaluate the impact future propulsion system controls will have on electronic components and constituent solid state materials.

Major aircraft engine companies will be contacted by the investigator to assist him in assessing electronic control needs for future high temperature jet engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0005, RAPID APPROACH FOR MISSILE SYNTHESIS (RAMS)

R. Birkell, General Dynamics Corp., *P.O. Box 1950, San Diego, California* 92112 (DF133140; F33615-78-C-3007)

It is often necessary to synthesize a large number of missile designs that meet different performance requirements so that mission effectiveness and design trade-off studies can be performed. To conduct these effectiveness and trade-off studies a rapid method or procedure is needed to synthesize various missile designs. This conceptual design procedure will allow one to select the most promising missile design for further exploratory development.

Develop a method to estimate the size, weight, range, maneuverability, accuracy, and cost for a conceptual air launched supersonic missile design. Using theoretical and empirical methods a procedure will be developed so that a missile design can be synthesized. By iterating the design through the established procedure a converged conceptual design will be obtained that meets desired performance specifications. From the converged conceptual missile design the various desired quantities can then be estimated. The procedure developed will be modularized and shall be such that a digital computer can be used to perform the calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0006, ELF POLAR FADING STUDY

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In Navy ELF radio propagation measurements, unexplained amplitude degradation has occurred frequently. It is postulated that energetic electron precipitation into the lower D-region ionosphere is the source of the amplitude degradation. The verification of this postulate is important in the design and sizing of the Seafarer ELF FBM Communication System.

Electron precipitation data taken by the ONR/ARPA Gamma Ray Research Satellite will be analyzed to determine the correlation of the ELF fading with electron precipitation along the propagation path. These results will then be used to predict the magnitude of fading due to PCA events and other high energy electron precipitation events, thus allowing a design margin to be built into the Seafarer system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, RESEARCH ON NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING

M. Chodorow, Stanford University, School of Humanities & Sciences, Dept. of Microbiology & Immunology, *Stanford, California* 94305 (DF044420; AFOSR-76-3070)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles requiring sensors of angular rotation rate in inertial space. However conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strapdown systems will offer considerable advantages, proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

The new approaches are based on the Sagnac effect like the ring laser. However in contrast to the latter, the laser source is outside the ring, pulse transmission and amplification in a multiturn loop is used, which leads to a frequency readout signal equivalent to that of a conventional ring laser. Optical fiber waveguides appear promising for constructing the sensing loops, offering unique advantages in fabrication and application. Calculations have indicated sensitivities in measurement down to very low rotation rates suitable for future navigation systems. This phase of the investigation continues experiments with components of what is referred to as the Active Re-entrant Sagnac System (ARS) using a CW He-Ne laser and a passive multiple fiber loop, then recirculation and sampling and later active recirculating of pulses from a solid state laser.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, NAVY VEHICLES DESIGN AND CONSTRUCTION - AUTOMATIC WIND-POWERED PROPULSION SYSTEM

R.M. Baker, Transportation Sciences Corp., *Playa Del Rey, California* 90291 (DN875439; N00014-78-C-0358)

The objective of this task is to test a system of rigid airfoils with self-trimming vane controls. The tests will produce definitive data on the performance of a wind-powered propulsion system for a remotely piloted marine vehicle. This energy-saving propulsion system may become competitive with other propulsion systems for such vehicles when principles of aerodynamic balance can be utilized for the efficient trim of sail-type wings in normal wind and sea conditions.

The development of the water support system for this remotely piloted marine vehicle was privately funded. The design of rigid sail-type wings with self-trimming vane controls, or aerodynamic balance, was funded by the ONR technology program. Tests were not performed, and the performance of this automatic wind-energy propulsion system remains to be demonstrated. A computer simulation of the craft exists in which these test data can be used to determine performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, PARACHUTE ENERGY ABSORBING DEVICES

L.C. Wickman, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN937025)

To provide fleet emergency egress systems with energy absorbing devices which will limit the deceleration applied by the parachute to aircrew men during deployment. Objective of this development will be to reduce peak decelerations from 40 g's to 15-20 g's. Such load reductions on personnel and equipment will extend the useful range of the survival equipment while reducing injury potential to personnel. Goal: limit maximum g loading attributed to parachute opening on aircrew men to 15-20 g's.

Metal deformation devices, high elongation polymers, and tearing devices were constructed and tested. All of these systems resulted in technical difficulties and/or undesirable features. In order to retrofit existing parachute/ejection seats, low bulk/weight/cost and adequate force limitation are all prime requisites. Present effort is centered upon ply-tear webbing, metal or plastic extrusion, and rotary metal deformation as the most promising energy absorbing mechanisms. These types of devices are being designed, fabricated, and competively tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0010, IDENTIFICATION OF FLAWS IN HIGH PERFORMANCE CERAMICS

G.H. Sines, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF049820; AFOSR-77-3425)

AF function - ceramic electromagnetic windows for radar and target acquisition allow combat aircraft to operate in all weather conditions. Deficiency - ceramic windows are, however, subject to brittle fracture originating from preexisting defects. Objective - the objective of this research is to identify the source and character of the defects which lead to mechanical failure in ceramic components. How work contributes - identification of the sources of failure is necessary in order to design nondestructive evaluation (NDE) techniques to find and reject components having unacceptable preexisting defects.

An eccentrically loaded column bend test will be developed to enable a number of small cracks (equivalent to 20) to grow without catastrophic failure occurring from just one worst flaw. The selective nature of slow crack growth from certain categories of flaws will be determined. New techniques which permit the identification of many flaws (greater than 10 to the 4th power) from the study of microspallation of a single compressively loaded specimen will be correlated with tensile fracture initiation sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0011, FINE SCALE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. Champagne, University of California, San Diego Campus, School of Engineering, Dept. of Applied Mechanics & Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (DF046560; AFOSR-77-3172)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding about turbulence and turbulent flows. Objective -investigate the phenomenon of relaminarization of turbulent pipe flow. How work contributes - many applications of interest to the Air Force are subject to relaminarization, i.e. diffusers and augmentors. Better knowledge of the basic mechanism of the relaminarization process will provide a better understanding of turbulence and transition to turbulence. This will be directly applicable to the design of future aerospace vehicles.

The experimental program for the relaminarization of turbulent pipe flow will be continued. Emphasis will be placed on determining the nature of the flow field for Reynolds numbers from 1900 to 3000 at 50 to 150 diameters downstream of the diffuser. The origin and evaluation of turbulent puffs will be studied for various Reynolds numbers in the relaminarizing flow. Data on the development of the puffs will be obtained using upstream flush mounted hot wire probes and an array of ten hot wires spanning the radius of the pipe.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, MATERIAL SUPPORT TECHNOLOGY - HIGH FIELD IN ELECTRON TRANSPORT IN SEMICONDUCTORS

D.K. Ferry, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DN875150; N00014-78-C-0124)

Improvement in or development of new electron devices for Navy electronics systems will require better understanding of the basic interactions of electric-field-driven electrons with the device material. Electron transport in advanced wide-bandgap semiconductors and insulators and in the interfacial region formed at the joining of two solid materials needs to be investigated.

High field transport of carriers in semiconductors will be studied theoretically and experimentally. There are four separate problem areas: (1) a theoretical study of the transport in the quasi-two-dimensional system such as the quantized inversion layer in MOS silicon devices, which will explore the scattering mechanisms in a two-dimensional electron gas and the effects of a nearly amorphous dielectric; (2) a combined theoretical and experimental study in wide bandgap semiconductors such as silicon dioxide and silicon carbide. Silicon carbide has great potential for applications to high temperature electronics, but many properties must be evaluated; (3) pico second optical pulses will excite fast electrons which lose energy to the lattice phonons. These interactions will be clarified in concept, and electron-phonon interaction strengths determined; (4) scattering mechanisms will be studied theoretically and experimentally in mixed cyrstal ternary and quaternary semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0013, INTENSE RAINFALL RATES AND THEIR EFFECTS ON MICROWAVE ATTENUATION

H.W. Hiser, University of Miami, School of Engineering & Environmental Design, Dept. of Mechanical Engineering, *Miami, Florida* 33124 (DA0F9111; DAAG29-77-G-0227)

To investigate intense rainfall rates such as occur in subtropical storms and their effect on microwave attenuation. Relevance - rainfall attenuation of electromagnetic propagation at microwave frequencies poses a serious problem for communication, navigation, homing and other related systems to be deployed for use in the 1980 time frame.

Three-dimensional models of rainfall rates in intense rain storms such as occur in subtropical storms will be developed using simultaneous measurements from rain-gages, radars and satellites. The resulting models will be used to predict microwave attenuation along horizontal and slant paths through the atmosphere, and to explain the attenuation observed during a 'COMSTAR Satellite K-band Propagation Experiment' conducted by the University of South Florida.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, COMPRESSOR RESEARCH FACILITY

J. Unitz, Cadre Corp., *2845 Clearview Pl., Atlanta, Georgia* 30362 (DF455760; F33615-73-C-2030)

The objective of this program is to contribute to the advance of the state-of-the-art of turbine engine compressor technology by (1) supporting exploratory and advanced development of compressor design, (2) improving compressor component characteristics, (3) determining steady-state and dynamic air flow characteristics, and (4) determining effects of steady-state and transient air flow on compressor performance.

The approach is a three contract, turn key effort having five (5) phases. Phase I - detail design; phase II - equipment procurement; phase III - installation; phase IV - inspection and maintenance of existing equipment; phase V - test and inspection. AFAPL utilizes a 10-man team to monitor the program (see Accession 455770 AFAPL in-house 30660412).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, MODULAR AVIONICS PACKAGING/STANDARD AVIONICS MODULE

R.H. Huss, U.S. Dept. of Defense, Navy, Naval Avionics Center, *Indianapolis, Indiana* 46218 (DN897005)

To develop a total avionics packaging concept for future Navy aircraft. Key technical performance objectives are to significantly increase system reliability, maintainability, and supportability while at the same time achieving avionics weight and volume reductions. The driving performance parameters are based on the projected requirements of the V/STOL 'A' aircraft.

The approach is to utilize integrated rack and standard module configurations for packaging of future avionics. The integrated rack concept has been shown to increase thermal efficiency (hence increase reliability), reduce weight and volume, and increase system maintainability. The standard module concept has been shown to increase reliability and reduce supportability costs. Prototype configurations will be developed, fabricated, and evaluated in laboratory and flight tests to demonstrate feasibility of the total concept.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0016, QUASI-OPTICAL TECHNIQUES FOR MILLIMETER AND SUBMILLIMETER-WAVE CIRCUITS

T. Itoh, University of Kentucky, Graduate School, *Limestone & Euclid, Lexington, Kentucky* 40506 (DA0F9077; DAAG29-77-G-0220)

To investigate both theoretically and experimentally a class of dielectric transmission lines suitable for millimeter and submillimeter wave components and integrated circuits. Relevance - results of the study are directly relevant to Army systems requiring low cost, reproducible millimeter wave components. Reviewers from miradcom and ECOM mention applications to missile sensors and terminal guidance, radar for mini-remotely piloted vehicles and communications.

To utilize surface wave propagation guided on the interface between a dielectric slab and a dielectric strip as a building block for millimeter wave integrated circuits. Particular emphasis will be placed on the utilization of grating structures within the guiding region to obtain (1) leaky-wave antennas and (2) high-Q band-pass and band-reject filters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0017, FLIGHT DYNAMICS--RESEARCH IN AERODYNAMICS--RESEARCH IN BALLISTICS

R.H. Krieger, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4437)

This project covers exterior ballistics research in aerodynamics related to projectiles and missiles and the factors affecting their flight behavior and environments. Significant studies undertaken involve methods to obtain static surface pressure measurements on non-spinning secant-ogive-cylinders; to develop a method and obtain surface pressure measurements on spinning bodies of revolution using a wind tunnel telemetry technique and to develop a *finite difference* computer program for computing the three-dimensional boundary layer development on spinning bodies.

These objectives are to be met through theoretical analysis and experimental testing in the BRL closed circuit variable density, continuous flow supersonic wind tunnels.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0018, STRUCTURAL RESPONSE ANALYSIS

J.M. Santiago, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0M4547)

The objectives are to enhance and augment existing structural response computer code capabilities in order to more realistically assess blast and fragment induced damage to complex engineering structures used by the Army (such as helicopter airframes, armored vehicle bodies, equipment shelters, reentry vehicles).

Effort will be made to acquire and implement on the BRL computer the most suitable finite element structural dynamics program capable of treating the nonlinear anelastic transient response of bulkheaded, stringered shell structures typical of airframe and armored vehicle construction. The initial phase of the effort would involve a literature search and evaluation of existing programs. After implementation of the program, suitable modifications to enhance treatment of new problems as encountered will be made. A subsidiary effort will be performed to enhance the strain predictions and boundary modeling capability of our in-house finite difference structural response program, REPSIL, and to modify the REPSIL/PETROS family of programs to treat cutouts and access openings by coding internal free edge boundaries.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0019, TRANSIENT RADIATION EFFECTS IN DIELECTRICS

H.E. Boesch, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland 20783* (DA0B5646)

Perform research, analysis, and testing to develop a better understanding of transient nuclear radiation effects on dielectric materials. The goal is to gain sufficient knowledge to accurately predict the response of materials and devices (integrated circuits, capacitors, cables) to nuclear radiation or to design these entities to assure proper operation in a radiation environment.

Determine the physical mechanisms of the permanent and transient radiation damage in organic and inorganic dielectric materials used in semiconductor devices, cables and capacitors. The charge generation, recombination, transport and trapping properties of the insulator will be determined following a short radiation pulse. The time dependence of the charge transport and the buildup of trapped charges in the bulk and at the insulator/metal or insulator/semiconductor interfaces will be examined. In the semiconductor devices mechanisms responsible for radiation induced interface states will also be investigated. Models describing the radiation response will be developed.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0020, LARGE APERTURE SYSTEM APPLICATIONS

Unknown, Charles Stark Draper Lab. Inc., *68 Albany St., Cambridge, Massachusetts* 02139 (DF911430; F30602-78-C-0128)

The objective of this effort is to assess active control concepts for disturbance suppression and performance enhancement of large aperture, ultra-lightweight space radar antennas. Also to develop design criteria for improved performance of such antennas with and without active control.

Active control approaches shall be analytically investigated for distortion suppression of modeled disturbance characteristic of large aperture, ultra-lightweight radar antennas for space applications. Mechanical/electrical implementations shall be assessed for both reflective and phased array antennas. Performance benefits shall be contrasted against passive distortion suppression approaches.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0021, FRACTURE MECHANICS AND BUCKLING

B.B. Budiansky, Harvard University, Cambridge Campus, School of Engineering, Dept. of Engineering & Applied Science, *Cambridge Station, Cambridge, Massachusetts* 02138 (DF049000; AFOSR-77-3330)

AF function - aerospace vehicles require improved understanding of fatigue and fracture processes so that designs of enhanced durability can be achieved. Deficiency - current design methodologies for structural failure are empirical in nature and result in premature failures and excessive inspection and space parts costs. Objective -the principal objective of this research effort is to understand the behavior of cracks and flaws in metallic structures. In particular, this research will investigate the influence of nonlinear material behavior in the vicinity of cracks on crack growth and fracture characteristics. How work contributes - based upon a deeper knowledge of crack behavior, improvements in airframe and engine designs can result which reduce Air Force cost of ownership.

This research is theoretical in nature. Theories will be studied which improve the predictive capability of establishing stress concentration factors when material plasticity is involved. These studies will include plasticity effects on stationary and growing cracks. In addition, plasticity effects on fatigue crack growth will be investigated and retardation factors investigated. Finally, within this framework the influence of creep on crack growth will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022. BASIC INSTABILITY MECHANISMS IN CHEMICALLY REACTING SUBSONIC AND SUPERSONIC FLOWS

T. Toong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF005060; AFOSR-78-3662)

AF function - advanced air-breathing combustion engines and chemical explosive weapons, weapon delivery and defense, close-air support. Deficiency - insufficient understanding of instability mechanisms, basic to many problems involving chemically reacting subsonic and supersonic flows associated with advanced air-breathing propulsion engines, chemical explosive weapons and lasers. Objective -to understand and develop accurate theoretical and mathematical models realistically describing the instability mechanisms involved in the mutual influence among sound, entropy, and vorticity modes in chemically reacting flows. How work contributes - will provide additional fundamental understanding and realistic analytical modeling of the various interactions involved in triggering and sustaining instabilities in reacting flow field, will contribute to resolving some of the controversies associated with ignition and propagation of unconfined fuel-air explosions, will aid in design and development of advanced stable power and propulsion systems and fuel-air explosive devices and chemical lasers, will aid in alleviation of noise pollution and in effective control and prevention of explosions.

Study will be made of instability mechanisms, basic to many problems involving chemically reacting subsonic and supersonic flows, e.g., problems related to combustion instability, chemical noise, detonation wave structure and stability and ignition, turbulence spectra in reacting flows, etc. Included will be studies of (1) chemical effects on generation and amplification (or attenuation of acoustic and non-acoustic (chemical) waves and their propagation), (2) chemical effects on generation of vorticity, (3) chemical effects on interactions among the three basic fluctuation modes in turbulence, viz, sound, entropy, and vorticity, (4) energy transport mechanisms among the fluctuation modes with and without chemical reaction, (5) non-linear wave kinetic interactions, (6) initiation and suppression conditions of explosions. In the experimental investigation, both Schlieren visualization and microphone monitoring will be utilized. Realistic mathematical models will be formulated and theoretical analyses will interpret the experimental results, with emphasis on elucidating the basic energy transport mechanisms involved in the interactions between chemical reaction and turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, FINITE ELEMENT SOLUTIONS TO TRANSONIC FLOWS IN AXIAL FLOW TURBOMACHINES

S.S. Wang, University of Mississippi, University Campus, School of Engineering, Dept. of Mechanical Engineering, *101 Carrier Hall, University, Mississippi* 38677 (DF043320; AFOSR-76-2982)

AF function - advanced gas turbine engine technology. Deficiency -lack of fundamental knowledge on flows through axial flow compressors. Objective - develop a numerical solution technique which can handle transonic flows through turbomachinery. How work contributes - better knowledge of flow fields through turbomachinery will allow designers to improve present empirical techniques used today in designing advanced turbomachinery compressors.

A numerical solution technique based on the finite element method for solving the fluid flow through an axial flow compressor will be developed for blade to blade flow. Once blade to blade flow has been shown to be solved, the results will be applied to the solution of meridional plane flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, EFFECT OF STRUCTURAL PARAMETERS ON ROTOR BLADE VIBRATIONAL CHARACTERISTICS

D.A. Peters, Washington University, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DA0F8964; DAAG29 77 G0103)

(1) To find the relationships between structural parameters and rotating beam vibrational characteristics; (2) develop an adequate model of the phenomenon; and (3) develop efficient computational methods for solving the problems of flap-lag-torsion vibrations of rotor blades. Relevance - highly relevant to current rotorcraft dynamics problems.

The approach will be theoretical using both modal and finite element techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025, ADHESION AND PHYSICS OF ICE

D. Itagaki, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0D8151)

To provide fundamental knowledge of the mechanisms and properties of ice adhering to surfaces of fixed and rotary-wing surfaces as well as other surfaces where the accretion and adhesion of ice interferes with the operation of materiel. To establish basic principles involved in the development of methods and techniques to remove ice from surfaces. To explore and develop means to prevent and/or alleviate icing. To evaluate and predict incidence and intensity of icing on the basis of readily available meteorological parameters.

The required information will be generated by a coordinated sequence of investigations including microscale evaluation of the physics and properties of ice adhering to interfaces, examination of the mechanisms of crack propagation in ice near an interface, and investigation of the interrelationships and influences of electrical properties on the mechanical properties of ice. Studies will also be pursued to determine in more detail the actual mechanism of accretion with attention centered on the freezing process of small droplets from the time they first impact to the time when they are frozen (accreted) or removed by the ambient air stream. Information developed will be disseminated to users and other project participants to provide a basis for improved design and performance of materiel. Foreign state-of-the-art is being considered.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

4.0026, SEPARATED FLOW AND TURBULENT BOUNDARY LAYER RESEARCH

S.M. Bogdonoff, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF041440; F44620-75-C-0080)

AF function - aerospace vehicles. Deficiency/opportunity - turbulent boundary layers and separated shear layers in supersonic flow are commonplace on airplanes, engine inlets and internal flow passages. Hypersonic turbulent boundary layers occur on reentry vehicles. In both cases the aerodynamic and heat protection design is often dominated by the necessity of coping with the turbulent boundary layers or the possibility of their occurrence. More complete understanding of these boundary layers could improve the design procedures and make it possible to build less costly and more effective aerodynamic and heat protection components. Objective - to conduct experimental studies in the following areas: 1) turbulence structure of an equilibrium, supersonic, high Reynolds number wall boundary layer, 2) detailed flow field structure of a two-dimensional supersonic turbulent shear layer reattachment region, 3) structure and properties of hypersonic turbulent boundary layers, and 4) structure of hypersonic turbulent free shear layers. How work contributes - increased understanding of the phenomena in these problem areas will permit significant improvement in designs of aerodynamic and thermal protective components of aerospace vehicles. Improvements may be in the form of increased vehicle capabilities or better cost-effectiveness.

Experiments will be performed in supersonic and hypersonic flows of air, helium, and nitrogen in the extensive gas dynamics laboratory facilities at Princeton University.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, CHANGE IN REFLECTIVITY OF METALS UNDER INTENSE LASER RADIATION

W.T. Walter, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering & Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DF051660; AFOSR-78-3557)

AF function - aircraft operating in future hostile engagements must be protected from intense laser radiation. High power lasers are also used for cutting, machining, drilling, heat treating and welding metals. Deficiency - the absorption of energy by the metal is critical in all cases and experimentally the reflectivity of a metal has been observed to decrease rapidly, by as much as a factor of 10, during a laser pulse of sufficient intensity. Objective - this research seeks to understand the mechanisms which couple energy from the electromagnetic beam into the material surface and results in the rapid loss of reflectivity. How work contributes - once the mechanisms are known, progress toward optimizing reflectance or absorption can be made by altering the chemistry and or microstructure of the materials.

An experimental program which is closely tied with an ongoing theoretical effort will be initiated. Reflectivity measurements of metal surfaces under intense laser radiation will be conducted in real-time using reflected laser light and a probe light source. Time histories of metal surface reflectivity during laser irradiation will be compared with theoretical predictions of nonlinear effects, surface deformation and vaporization or plasma blowoff to attempt to explain the steep initial decrease in metallic reflectivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, ANTENNA FEED TECHNIQUES

P.R. Franchi, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903710)

To provide a simple design that will have very low sidelobe yet will be capable of electronic scan in elevation with a wide bandwidth. The requirements of possible future tactical air surveillance radars are the goals set for this effort.

The design, fabrication and testing of a (pill-box type) reflector-feed system. This type antenna will provide information on the azimuth pattern of a large parabolic cylinder with a phased array feed system. The feed spillover, illumination taper, and impedance and reflector tolerance are the critical concerns.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0029, PRECISE REFRACTION CORRECTION SYSTEM FOR SLBM RADARS

L.E. Telford, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF901240)

AF function - improve techniques for providing tropospheric refractive bending and range error corrections for precision radar and navigation systems. Deficiency or opportunity - present methods of correcting for tropospheric refractive bending and range error assume a horizontally stratified atmosphere and rely on data collected at one surface site. For low elevation angles these methods usually fail since the ray traverses long horizontal distances and the assumption of horizontal stratification is not met. This results in unacceptable refraction correction for low elevation angle tracking. Objective -design, fabricate and test a three frequency millimeter wavelength radiometer system to provide atmospheric emission data which has been shown to improve low elevation angle refraction correction prediction. How research contributes - atmospheric emission data at millimeter wavelengths have been found to be of value in improving the prediction of refractive bending and range error at low elevation angles.

A prototype of a three frequency radiometer system will be procured under contract and tested under pseudo-operational condition at one of the USAF precise radar sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0030, STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND FLUID FLOWS

E.L. Reiss, Miami University, Graduate School, *Oxford, Ohio* 45056 (DF053290; AFOSR-78-3663)

AF function - to design stable aerospace structures. Opportunity -a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - aircraft structural design techniques are almost entirely based on linear elastic models. Present aircraft, however, operate in the nonlinear elastic regime with portions of the structure buckled or wrinkled. Improved nonlinear design techniques are being sought. How work contributes - original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield of non-singular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection-sensitive bifurcation points of high multiplicity, periodic and quasi-periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION

T. Compton, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN890051; N00019-78-C-0131)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communications systems to reduce or eliminate signal interference.

The research study on adaptive antennas will include (1) concepts for identifying single side band (SSB) and frequency shift keying (FSK) signals without increasing the bandwidth of the system, (2) techniques of frequency acquisition in adaptive arrays, and (3) investigation of methods for phase tagging desired signals that do not produce significant envelope distortion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0032, ROTOR FLOW FIELD RESEARCH IN LOW-SPEED HELICOPTER FLIGHT

H.R. Velkoff, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mechanical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DA0E9182; DAAG29 76 G0260)

To experimentally examine and define representative flows past rotors and rotors-fuselage-empennage configurations which model a helicopter in a transitional flight regime. This research investigation is highly relevant to ongoing research at AMRDL in rotor aerodynamic environments characteristic of NOE operations and hence will impact the technological requirements of improved airfoil design, performance, dynamics and handling qualities.

Model rotors, fuselages, and empennages will be designed, fabricated and put in a small wind tunnel, and tests will be performed which consist of measurement of velocity distributions in the wake as well as flow visualization to define the characteristics of the flow peculiar to rotors in low advance-ratio flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0033, AVIONICS EVALUATION PROGRAM

K.C. Almquist, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF098030)

Perform in-house analyses of air-to-ground weapon system concepts utilizing a computerized model. The analyses quantitatively assess the impact of avionic reliability, subsystem performance and system survivability on mission effectiveness. Sensitivity and trade-off analyses performed under this effort will provide performance data to engineers involved in concept synthesis and analysis.

Utilize the Avionics Evaluation Program (AEP) to perform trade-off and sensitivity analyses. The AEP is an air-to-ground mission effectiveness model which has been implemented in a conversational interactive graphics mode. Data generated using the AEP include number of targets killed, targets acquired, A/C lost and mission aborts, avionic utilization data, avionic black box failures, subsystem performance data and weapon delivery error sensitivities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0034, GROOVED RADOME AERODYNAMIC TESTING

R.A. Neidhard, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF112000)

The objective is to determine aerodynamic performance of broadband orthogonally grooved radome configurations when designed for millimeter wavelength (30-100 GHz) frequencies. The radome mockups will have shallow (.050 inch) longitudinal grooves on the exterior surface with similar orthorgonal grooves on the inner surface. The general radome mockup shape will be that of a 6/10 inch diameter air-to-air missile. There is similar interest in aerodynamic performance for A/C leading edge wing installations for threat warning receiver applications. The purpose of the aerodynamic testing is to determine feasibility of exposed grooves designed for millimeter wavelength frequencies, such that detailed electrical design, development, and testing can be initiated in FY78.

This program will be accomplished through the AF Flight Dynamics Lab drawings of the radome mockup exterior shape and groove dimensions will be given to AFFDL. Construction of the mockup will be accomplished by one of their local support contractors. Testing and data reduction will be performed in-house by AFFDL. The principal measurement to be made is aerodynamic drag induced by the presence of the grooves. Testing will be initially made with grooves in place, subsequently, the grooves will be filled with clay to collect comparative ungrooved data. Contingent upon successful aerodynamic drag test results, a program will be initiated in FY78 to develop and test both ceramic and plastic millimeter radomes for missile and A/C applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0035, INVESTIGATION OF COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER

D.E. Abbott, Lehigh University, Graduate School, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DF052500; F49620-78-C-0071)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the structure of turbulent boundary layer flows. Objective - to disclose the three-dimensional details of the convected coherent structures of turbulent boundary layers and to develop new flow models for improved predictive methods. How work contributes - new and improved prediction methods for turbulent boundary layer flows are needed by designers of advanced aerospace vehicles. This effort is directly related to providing this information.

Flow visualization of wall boundary layer flows in a water channel using transverse and vertical hydrogen bubble wires will be observed in a convected frame of reference. Video presentations of the flows will be made using orthogonal views of the structure of the turbulence or detailed views of a portion of the boundary layer while simultaneously viewing the entire layer. Quantitative data of the turbulence will be obtained through digitization of the video data and by hot-film measurement. The effects of surface roughness, transpiration and suction will be investigated. Interactive theoretical studies will be conducted to provide analytical expression and theoretical basis for the observed phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, INVERSE SCATTERING - IONOSPHERIC STRUCTURE DETERMINATION

J. Cohen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DF052790; AFOSR-78-3608)

AF function - radio communication and control. Opportunity - a newly developed method for data processing seems applicable to ionospheric probing. Objective - real-time measurement of F layer irregularities. How work contributes - scintillation characteristics of radio wave propagation will aid development of optimized modulation and diversity schemes.

Present ray based algorithms for ionospheric probing induce only the near side of peaks in index of refraction. Newly developed wave based inverse scattering techniques seem capable of determining the far side of the peak as well. Amplitude and phase data versus frequency for vertical propagation will be obtained on a quiet day near the magnetic equator. A definite variational principle for the Gelfand Levitan equation will be used to construct and obtain error bounds for the variation of index of refraction in the F layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, SAW RESONATORS

W.R. Shreve, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DN680329; N0004-75-C-0824)

There is a need for improved secure and covert communications systems for applications ranging from voice communications to remotely piloted vehicles. The objective of this program is to develop advanced state-of-the-art VHF and UHF signal processing components for communications systems under development.

High Q filters will be developed for the VHF and UHF bands using SAW resonators. Basic limitations of these devices will be identified and overcome so far as is practical or is required for systems applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0038, ATMOSPHERIC TURBULENCE EFFECTS ON THE TEMPORAL-SPECTRAL DENSITIES OF OPTICAL SIGNALS

J. Smith, University of Texas, El Paso Campus, School of Engineering, Dept. of Electrical Engineering, *El Paso, Texas* 79999 (DA0H5579; DAAG29-78-G-0027)

To develop models for optical crosswind systems to describe the temporal spectral densities of remote scenes viewed through a turbulent atmosphere. Relevance - atmospheric turbulence effects over different ranges are important in several laser propagation systems being developed or currently used in the Army. ASL is particularly interested in turbulence effects in the laser remote sensing crosswind measurement system under development for use in the main battle tank. 'The program could be relevant and important for laser weapon systems or systems employing laser guidance.' (MICOM). 'The resolution of the effects of saturation is fundamental to the application of this scheme (optical measurement of wind) under many turbulence-path-length conditions.' (BRL).

Simulataneous measurements yielding the spectral densities obtained from intensity and angle of arrival fluctuations of remote scenes and of beams from coherent sources will be made over 0.5 km and 2.0 km horizontal paths during periods of strong and weak turbulence and a variety of wind conditions. The spectral characteristics will be compared with in-situ measurements of related meteorological parameters to check the validity of the model predictions. Upon establishment of the expected spectral characteristics, spatial and temporal filters will be used to obtain wind profiles along the path.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0039, POSITRON ANNIHILATION STUDIES OF DEFECTS IN SOLIDS

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AF function - nondestructive evaluation (NDE) of materials before and during service saves the Air Force many lives and millions of dollars annually. Structural (airframe) and high performance (turbine engine) materials must be inspected periodically and evaluated to determine their continued use or need for replacement. Deficiency - many critical defects such as metal fatigue and small cracks are impossible to evaluate with current nde techniques. Objective - this research seeks to develop a new technique, positron annihilation, to inspect small internal defects in metals. How work contributes - early detection of fatigue and other types of damage in operational structures is essential to their continued reliable, safe operation.

Positron annihilation techniques will be used to study pure aluminum and alloys of Al-Cu, Al-Zn, Al-Li, 7075 and 2024. Aging and deformation conditions will be studied to assess the utility of this method for nondestructively evaluating the structural properties of aluminum alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, RESTORING IMAGES DEGRADED BY ATMOSPHERIC TURBULENCE

C.K. Rushforth, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Electrical Engineering, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF047250; AFOSR-77-3212)

AF function - surveillance and detection of missiles and satellites. Deficiency - degradation of images produced by atmospheric turbulence. Objective - to produce a practical procedure for achieving increased resolution in the presence of atmospheric turbulence. Contribution - increase of resolution in images degraded by atmospheric turbulence.

Initial efforts conducted on one- and two-dimensional simulations of two recently (1976) proposed techniques of image restoration will be refined and improved using existing statistical models of the atmosphere and of sensor noise. The Knox-Thompson procedure obtains amplitude and phase information separately from two different averages taken over a number of short-time images. The amplitude and phase are then combined to obtain estimate of the object intensity distribution from the inverse Fourier transform. The Sherman procedure treats the object as a whole and solves an integral equation in terms of measured data and known statistical parameters. Modified or alternative procedures will be sought which have better performance and reduced computational requirements. Underlying approximations will be investigated and such features as sparse matrices will be exploited to facilitate computation. The best procedure will be applied to a large quantity of astronomical data to improve the procedure and increase our understanding of its operation and to obtain significant astronomical results. Suitable data will be obtained through continued collaboration with Kitt Peak Observatory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, MIXING OF SWIRLING FLOWS AND BEHAVIOR OF WET FLOWS

G.C. Oates, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF052130; F49620-78-C-0063)

AF function - advanced turbomachinery. Opportunity - improve our understanding of the flow through an axial flow turbomachine. Objective - to conduct an investigation into 1) the mixing behavior of swirling flows and 2) the effects of water droplets and water vapor on the flow processes within transonic fans. How work contributes - will provide fundamental knowledge needed in order to provide solutions to two constantly reappearing problems of high performance turbomachinery.

An investigation will be conducted in two areas. In the first area, which will study the effect upon mixing by swirling the inner stream of two co-annular streams, the first step will be to construct the required test facility. Once completed, detailed investigations concerned with obtaining data on the mean flow will be carried out. Parameters to be varied will include degree of swirl, pressure gradient and variation in geometric shape of inner annulus. In addition, a theoretical investigation will be carried out with the goal of developing a method capable of predicting the mixing behavior of swirling flows. In the second area, which will study the effect of water droplets and water vapor on the flow processes, the experimental study will study the behavior of water droplets passing through a shock. An extension of Marble's theory would also be undertaken. Results of analysis and experiment would be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, LATITUDINAL STRUCTURE OF SOLAR WIND STREAMS FROM RADIO SCINTILLATION OBSERVATIONS

B.J. Rickett, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (DF248790; F19628-77-C-0161)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate means to determine conditions within solar-wind streams. Objective - to recognize from coronal radio and optical observations which high latitude coronal structures can give rise to solar wind streams in the ecliptic. How research contributes - provides the observational tools necessary to predict conditions in the solar wind as it effects the terrestrial space environment.

Observe the solar wind speed in and out of the ecliptic by the method of interplanetary radio scintillations and compare these with geomagetic and coronal optical observations. These data will then be compared with spacecraft observed solar wind data to infer correlations among the various types of data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0002, ATMOSPHERIC PHYSICS (ATMOSPHERIC ELECTRICITY AND CLOUD PHYSICS)

W.A. Hoppel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480215)

Provide new and improved capabilities to the Navy in overcoming operational difficulties caused by hazardous environmental conditions and in using the environment to an advantage. Achieve a better understanding of cloud and fog dynamics, nucleation, glaciation, condensation, atmospheric electrification, pollution, and atmospheric radioactivity.

Perform interrelated laboratory, field, and modeling experiments and develop the theoretical tools necessary to explain and predict the observed results. Field experiments include the use of aircraft, ships, and ground field sites as platforms for data acquisition. The data acquired from laboratory and field investigations are analyzed and compared to the predictions of current theoretical models with the aim of improving these models and our understanding of atmospheric physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0003, ENVIRONMENTAL SUPPORT TECHNOLOGY - MARINE GEOCHEMISTRY AND ITS EFFECT ON NAVAL OPERATIONS

F.K. Lepple, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020191)

To investigate the chemistry and distribution of aerosols in the marine environment; to relate aerosol composition to different sources (the oceans, the continents, volcanism and atmospheric processes) and to meteorological events and geogrpahical location; to investigate the chemical composition of the boundary layers at the air-sea interface. The Navy needs this information for ASW remote sensing technology and for long-range weather prediction.

Marine aerosol samples are collected aboard ships and aircraft over different ocean areas mainly employing NRL-developed sampling devices. Chemical composition of these marine aerosols including sea fog and rain is determined by instrumental neutron activation analysis, X-ray methods and various wet chemical and spectroscopic techniques. Equipment and methods for real-time monitoring of related parameters are simultaneously evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0004, CONTINUOUS OPERATION OF THE GEORGIA TECH METEOR WIND RADAR 1978-81

R.G. Roper, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ATM7811741)

This grant funds a program of research which continuously measures the winds at mesopause altitudes (80-100 km) above Atlanta (34 degrees N, 84 degrees W) using the established Georgia Tech Radio Meteor Wind Facility. Those measurements which have been made since August, 1974, have shown the necessity for continuous operation in order to observe the planetary wave portion of the dynamic spectrum, and to attempt to detail the synoptic meteorology of the mesopause level. Such data, in conjunction with that gathered by other members of the Global Radio Meteor Wind Studies Project, is essential to the production of global models of the circulation in the neighborhood of the mesopause, and in providing 'ground truth' for proposed measurement of mesopause dynamics from satellites. The determination of the dynamics of the mesopause is a key objective of the Middle Atmosphere Program of the Special Committee on Solar Terrestrial Physics, scheduled for the next decade.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0005, SPECTROMETER

R.P. Crabbs, Research Support Instruments, *Timonium, Maryland* 21093 (DF249970; F19628-75-C-0154)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Contractor shall design, fabricate and test a balloon-borne ultraviolet spectrometer for the measurement of solar radiation in the range between 2000 and 3100 angstroms. After each balloon flight, the instrumentation will be refurbished and prepared for a subsequent flight. Four balloon flights of the solar spectrometer are planned to provide data on the solar spectrum as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, NAVY ENVIRONMENT - SOLAR TERRESTRIAL RELATIONSHIPS

R. Markson, Airborne Research Associates, *46 Kendal Common Rd., Weston, Massachusetts* 02193 (DN475450; N00014-74-C-0336)

The major objective of this research is to subject to experimental verification a plausible mechanism through which variable solar activity might influence tropospheric weather. If the hypothesis were to be verified, the result would contribute to important corrections of and improvementS in the naval weather forecast.

Two separate data sets will be used in the experimental verification. One is the thirty year collection of thunderstorm data developed up to 1965 by Mae Lethbridge of the University of Pennsylvania. She has just received a grant from NSF to bring this up to date. This data will be examined for variability of thunderstorm activity with magnetic sector crossings. The other set of data is the GOES Satellite infrared pictures. Under this contract, we have developed software by which we can obtain distributions of cloudiness within latitude/longitude squares of variable size. We can also examine this data against the magnetic sector crossings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, A GLOBAL STUDY OF THE VARIATIONS IN UPPER-ATMOSPHERIC COMPOSITION THAT ACCOMPANY TRANSIENT CHANGES IN THE EARTH'S MAGNETIC FIELD

L. Jacchia, Smithsonian Institution, Astrophysical Observatory, Analytical Satellite Geophysic, *60 Garden St., Cambridge, Massachusetts* 02138 (SRF - 460117)

Through analysis of mass-spectrometer data from the ESRO-4 satellite, Dr. Jacchia plans to model the large changes in composition which accompany geomagnetically induced density variations. A preliminary model of these atmospheric variations is already designed.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

5.0008, SELF CALIBRATING FREQUENCY DIVERSITY DOPPLER WEATHER RADAR

A.W. Bishop, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581350)

AF function - navigation and detection functions of the strategic, tactical, air defense, and airlift forces. Deficiency - weather radar systems in current use are unable to separate hazardous from non-hazardous zones in storm systems. Objective - to develop a frequency diversity Doppler weather radar with a self calibrating capability. How development contributes - provides an improved weather radar system which enables the reliable identification of storm hazards on the basis of their Doppler spectral characteristics.

This in-house effort will be accomplished by modifying an AN/FPS-18 transmitter-receiver to give a frequency diversity Doppler system with performance characteristics comparable to specifications contained in multicommand ROC 4-6-76 for an advanced weather radar. This work is a continuation of work heretofore conducted in in-house work unit 66720602.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, DEVELOPMENT OF NEW TECHNIQUES FOR SOON MEASUREMENTS

H.L. Demastus, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580790)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to improve present techniques and develop new ones for the collection and interpretation of magnetic data from the Solar Observing Optical

Network (SOON) in order to generate better predictions of solar-induced geomagnetic disturbances. How research contributes - when completed, SOON will provide the only continuous coverage of solar acitivity in the optical wavelength region. To maximize the potential of SOON for reliable flare prediction, techniques must be perfected for extracting the required data from these telescopes in a highly efficient manner. The Air Weather Service, which is responsible for accurate disturbance forecasts, depends on PHS for technical expertise and guidance in the operation of SOON.

Technique development will include improved computer algorithms, theoretical analyses, both by contractors and by in-house work unit 2311G309 under this task, and new hardware for the study of active region magnetic and intensity fields. Some of the hardware will be built by contractors. It will be of an experimental nature and feasibility studies will be conducted on existing SAC Peak Telescope, prior to attempting modifications of SOON to incorporate these features. Data from SOON, SAC Peak and other instruments will be used in these studies. Close cooperation with AWS is anticipated in data gathering, archival, and distribution. PHS will coordinate scientific efforts between AWS and the outside solar physics community. A CWU 'sunspot dynamics' will report on conditions in sunspot regions which may lead to flares.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, PCM TELEMETRY AND CC FOR BALLOONS

A.A. Giannetti, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248870)

AF function - advance balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency - existing instrumentation systems do not meet control and telemetry requirements for proper evaluation of AF payloads. Objectives - design, develop, and test hardware and software for balloon PCM flight systems to provide real-time data documentation and manipulation through the use of a minicomputer. How research contributes - the new instrumentation will provide the necessary accuracy and format for the proper logging and display of vital scientific data essential for proper evaluation of AF scientific balloon-borne payloads.

An existing PDP11/40 computer will be interfaced with a PCM ground station and a software program will be developed for data handling, logging and manipulation. An airborne PCM system will be developed in-house to meet most scientific technical requirements and used to verify and evaluate the overall system capability. A contract will be utilized to support this work, both for component fabrication and for interface, installation and software development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, THE OZONE ABSORPTION SPECTRUM IN THE UV REGION

D.H. Katayama, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581170)

AF function - environmental impact of high altitude vehicles. Deficiency - effect of aircraft effluents on solar UV absorption and on ozone. Objective - measure and analyze the absorption spectrum of ozone. How research contributes - the ozone absorption spectrum will be analyzed to improve ozone concentration computations used for determination of the environmental impact of Air Force vehicles.

The absorption spectrum of ozone in the UV region will be analyzed by studying its isotope shifts. An ozonizer with its associated vacuum system and various absorption cells will be used with a 3M spectrograph. The ozone absorption data will be recorded in the UV region at various pressures, temperatures, and cell lengths.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, ELECTRIC FIELDS IN THE IONOSPHERE AND MAGNETOSPHERE

M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249360)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modeling. Deficiency - environmental electric fields produce plasma motions which degrade orbital prediction and tracking accuracy as well as limiting the use of velocity vector sensors (VVAS) for satellite and missile guidance systems. They also cause irregularities which seriously degrade electromagnetic propagation prediction progress. Nuclear burst debris is diffused by electric fields, modifying the radio blackout observation of the burst. Objective - FY77 - new instrumentation will be developed for environmental electric field and vehicle potential measurements at synchronous altitude and at rocket altitudes in the auroral zones. Analysis of results from past rocket flights will be completed, integrated with simultaneous particle and optical emission measurements, and prepared for publication. How research contributes - models of electric fields and currents in the ionosphere and magnetosphere will significantly improve AF prediction capability of electromagnetic propagation and nuclear burst debris radio blackout conditions. It will minimize errors in satellite and missile ephemeris and tracking prediction and will define operational and design parameters for velocity vector guidance sensors.

Electric field measurements carried out by means of rockets and satellites and analytical studies are carried out based on the results of these experiments. The global F region electric fields will be mapped and the influence of electric fields on spacecraft charging determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, HYDROXYL AIRGLOW MEASUREMENTS

G.T. Best, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF580490; F19628-78-C-0098)

AF function - surveillance, reconnaissance, early warning. Deficiency - insufficient data to predict background radiance levels and spectral distributions in a disturbed atmosphere, particularly temporal-spatial variations. Objective - obtain additional laboratory and field measurements of the hydroxyl airglow phenomena, particularly nocturnal variations of emission intensity, rotational temperatures and an empirical photon emission rate constant. How research contributes -expected to enable the prediction of hydroxyl airglow intensity from known reactant concentrations. OH measurements from ground observations will provide data on the spatial and temporal airglow variations due to gravity waves or travelling ionospheric disturbances.

Conduct an in-depth investigation of the hydroxyl airglow phenomenon using A) laboratory measurements of the photon emission rate constant for the reaction hydrogen plus ozone yields hydroxyl plus oxygen, including dependence on reactants concentration, their ratio, and temperature dependence. Also, the quenching coefficient will be determined. The spectral distribution of the chemiluminescence will be obtained, and the photon emission rate constant will be measured for the individual bands as well as the total radiation. B) Ground-based observations of the hydroxyl emission in the various vibrational bands, and verification of spatial emission irregularities by scanning the celestial hemisphere with a narrow-field-of-view photometer. C) Computerized modeling of the hydroxyl airglow based on best available density profiles of hydrogen and ozone, and the laboratory determined rate constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, THREE-DIMENSIONAL SLOPE AND VALLEY WIND SYSTEMS 12461-GS

W. Tang, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DA0T5572; DAAG29-78-G-0012)

To model variations in wind circulations in a three-dimensional slope and valley-plain terrain situation, coupling the interactions between the upper air flow and the thermally induced lower level winds which vary diurnally. Relevance - three-dimensional modeling of air motion over complex terrain has relevance

to transport and diffusion of obnoxious materials; for identifying optimal conditions for laying smoke screens; for wind effects on artillery accuracy, low level helicopter operations, and other Army activities in mountainous terrain. The study should contribute to the development of operational terrain effect models for the Army's automatic meteorological system.

The research involves the development of the governing differential equations for air motion and temperature above mountain-valley terrain. The equations will be solved numerically and the results checked with analytical solutions and with real data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0015, REMOTE SENSING WOODED WETLANDS USING LANDSAT MULTISPECTRAL SCANNER DATA

W.P. MacConnell, University of Massachusetts, Amherst Campus, Agricultural Experiment Station, McIntire Stennis Program, *Amherst, Massachusetts* 01002 (0076742; MAS00029-MS)

OBJECTIVE: Evaluate the utility of various LANDSAT Multispectral Scanner products for detecting and correctly identifying wooded wetlands in Massachusetts. These image products will be enhanced to accentuate specific features associated with wetlands. The enhanced images will be used by skilled personnel to interpret the wetlands and these results will be compared with results obtained using conventional aerial photographs and corollary wetland information produced from aerial photographs in work done here in MS-13 research. Evaluate the feasibility of automatic data processing of digital LANDSAT data to identify and classify wooded wetlands in western Massachusetts. Evaluate the potential for development of a system of integrated remote sensing techniques to provide regional or state-wide vegetation and land-use data or computer maps on an annual basis.

APPROACH: See item No. 24.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Massachusetts

5.0016, OPTICAL DENSITY MEASUREMENTS

O. Shepherd, Vitidyne Inc., *Burlington, Massachusetts* (DF247140; F19628-76-C-0253)

AF function - low altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies of AF predictive capabilities of missile trajectories and satellite ephemerides due to lack of density data at critical altitudes. Objective - development and test of remote sounding technique using laser propagation and scattering technology for measurement of atmospheric density in the lower thermosphere. How research contributes - laser experiment will provide measurements of atmospheric density over the critical altitude region from 80-160 km.

Develop, fabricate and test laser rocket sounding experiment to be flown to determine the accuracy, range and reliability of the technique for use in remote sounding applications for the measurement of atmospheric density.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, SNOW COVER ANALYSIS IN NEW ENGLAND USING LANDSAT DIGITAL DATA

C.J. Merry, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31584)

OBJECTIVE: To synoptically map snow cover and to determine if a relationship exists between the water equivalent of the snowpack and the associated radiance values obtained from LANDSAT computer compatible tapes (CCT's).

APPROACH: Digital processing of selected CCT's will be accomplished to map the areal extent of snow. The next step will be to test if a relationship exists between the water equivalent of the snowpack and the associated radiance values on the LANDSAT CCT's. Snow course data in two New England watersheds will provide the ground truth to enable this comparison to be made. In addition, a newly developed microwave sensor to quantitatively assess the water equivalent of the snowpack will be tested. LANDSAT spectral band ratios of the radiance for selected snow course sites that provide the most reliable information for correlation to the water equivalent of snow data will be evaluated. The number of ground truth data stations required when using the CCT's for reliable prediction of water runoff associated with the snowpack will also be determined. Significant savings in costs can result if snow surveys can be accomplished using LANDSAT digital data rather than ground survey procedures. The results of this investigation will be presented in ETL's and technical reports for use in flood forecasting in cold regions.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0018, BALLOON-BORNE RADIOSONDE

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (DN223113; N00014-75-C-0168)

This research, as part of a coordinated program of thunderstorm research with other investigators, aims at ascertaining the relationships between the thunderstorm electric field and the cloud circulation and precipitation regime. Application will be to improve the naval weather forecast and in-cloud flight paths.

In situ measurements of the electric field with a balloon borne electric field meter are made simultaneously with radar observations of the cloud precipitation. These measurements are combined with other coordinated ground and aircraft measurements of other investigators to gain a better total perspective of cloud meteorological and electrical characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0019, GRAVITY AND ACOUSTIC WAVES APPLIED TO THE DYNAMICS AND KINEMATICS OF THE ATMOSPHERE

W.L. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DA0F9005; DAAG29 77 G0131)

To develop the application of infrasound as a possible probe for the remote sensing of wind-temperature parameters of the stratosphere and lower thermosphere and the relation of gravity waves in the atmosphere to meteorological conditions. Relevance - the research attacks several Army meteorological problems, including the role of internal gravity waves in determining the structure of the upper atmosphere and the response of the upper atmosphere to nuclear disturbances, the relation between gravity waves and precipitation and severe storm development, remote sensing of wind-temperature parameters of the upper atmosphere, and detection of ballistic missiles in flight for early warning.

Use observations from the present ground array of capacitor type microphone sensors at Lamont Observatory and a companion array to be established at the meteor radar laboratory of the University of New Hampshire to compare estimates of wind conditions at reflecting levels aloft to those determined by radar echoes from meteor trails and study the effect of gravity waves on precipitation and severe storms.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0020, OBSERVATION OF VHF BEACONS OR SATELLITES

K. Pai, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Army Research Office, *P.O. Box 12211, Research Triangle Park, North Carolina* 27709 (DF580020; AFOSR-74-0215)

AF function - navigation. Deficiency - signal fading, pulse delays, refraction errors. Objective - measures ionospheric parameters related to geomagnetic activity. How research contributes - results used to develop global predictive models of scintillation and total electron content. Models support AFSATCOM

and GPS development. Work is done in conjunction with the Joint Satellite Studies Group.

Signals from transmitting satellites will be monitored to determine morphology and statistics of ionospheric total electron content and scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, ESTIMATION OF SHORT-WAVE AND LONG-WAVE RADIATION FOR CLIMATIC MODELS

J.J. Cahir, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (8-414; 04-6-158-44013 MOD. NO. 6)

TECHNICAL OBJECTIVE: The objective of this research project is to generalize the previously developed overland statistical equations to account for diurnal and seasonal effects, to re-derive comparable equations over the oceans, and to conduct limited diagnostic studies concerning the radiative characteristcs of varying cloud height over oceans.

APPROACH: A limited sample of geostationary satellite data and conventional hydrodynamic data will be applied to the over-land regression model to account for diurnal variation, at least in the summer. Seasonal variation of the models will be tested, using summer equations all year at low latitude, winter equations all year near the Pole, and letting the winter/summer boundary migrate with time of year. Data for this test are available in the NESS archive, TDL, and on hand from previous work. Regression equations over the oceans will be re-derived, using data from the 6-layer Primitive Equation Model archive for such points, where there are approximate time-correspondence to the polar orbiters. The plan also calls for some limited diagnostic studies concerning the mean depth of cloudiness over oceans by combining the longwave and shortwave regression equations.

PROGRESS: Regression equations which satisfactorily predict the shortwave and longwave radiation components for both winter and summer regionally over continents have been developed, tested and published. Preliminary results from work on the corresponding over-ocean problems, however, are less satisfactory due partially to the unrealistic temperatures used from the operational LFM model.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, NAVY ENVIRONMENT - BALLOON CLOUD PROBES

A.A. Few, Rice University, Graduate School, Dept. of Space Science, *6100 Main St., Houston, Texas* 77001 (DN123363; N00014-75-C-0139)

To apply modern balloon technology to the probing of maritime clouds in order to support naval operations through a better comprehension of atmospheric phenomena.

Balloons of special construction will be prepared with sensing equipment and telemetry contained within the balloon. The balloon surface will also be used for sensing. The balloons will be released as free balloons into clouds and be supplemented and compared with standard radio sounding techniques. Standard radiosondes will be modified to produce low cost thunderstorm sounding devices.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, COMPUTER MODEL OF PLASMA FLOW NEAR THE EARTH'S PLASMAPAUSE

R.A. Wolf, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (DF248280; F19628-78-C-0078)

AF function - communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of how convective processes in magnetosphere perturb ionospheric structure characteristics which in turn affect AF communication systems design. Objective - develop computer models for time-dependent convective flow, analyze and synthesize AF satellite data. How research contributes -provides data essential to radar propagation, provides data essential for design and utilization of communication, guidance and surveillance systems, provides understanding of dynamical ionospheric/magnetospheric processes.

Construct computer models for time-dependent convection in the ionosphere and magnetosphere at auroral and middle latitudes using electric fields and plasmas observed by AF satellites as realistic boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, NIMBUS 6 CLOUD EVALUATION

K.N. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581910; F19628-78-C-0130)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - limited ability to specify and forecast cloud conditions in real-time. Objective - develop techniques to parameterize weather satellite microwave and infrared imagery data for the inference of cloud properties. How development contributes - a successful development will lead to improved cloud detection from satellites and improved input to cloud forecasting models.

For a variety of cloud conditions, radiances measured by the Nimbus 6 Satellite will be compared to conventional sources of weather data. The observed radiances will also be compared to radiances calculated from a model of radiative transfer in cloudy atmospheres for ice and water clouds over a range of visibilities and thicknesses. Combinations of microwave and infrared channels which best identify cloud properties will be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, NAVY ENVIRONMENT - UPPER OCEAN MESOSCALE RESPONSES TO ATMOSPHERIC FORCING NEAR STATION PAPA

R.W. Burling, University of British Columbia, Inst. of Oceanography, *2075 Westbrook Pl., Vancouver, British Columbia, Canada* V6T 1W5 (DN624127; N00014-77-G-0047)

The Navy has a need to gain an understanding and improved predictive capability of the characteristics of the mixed layer and its response to air-sea interactions, particularly to strong wind events. These include (1) the lower atmospheric boundary layer needed for forecasting radar propagation and mixed layer depth changes, (2) upper ocean wind induced drift currents, and mixed layer structure for surface duct acoustic propagation, and (3) the predictive capabiltiy of simple anemometry devices to forecast ocean wind waves. The objective of this task is to conduct a field investigation at Ocean Station Papa to assess recent models of air-sea interactions and mixed-layer responses to strong winds.

Instrumentation has been developed to measure the fluxes of heat, moisture and momentum from the air-sea atmospheric boundary layer into, and out of, the upper ocean. Both direct and indirect methods of measuring Reynolds flux from the wind to wind waves are compared to assess drag law predictive capabilities of storm generated wind waves. Analysis of 10 years of Ocean Station Papa data has been done and a study of Ocean Station Papa data this year is underway to publish the data. Navy aircraft have been utilized to monitor the temperature structure before and after storm passage.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, UPT DATA BASE

M. Nataupsky, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223250)

To identify long-term effects of diverse viarables on flying performance, to determine the relationship between daily grades and check grades, and to evaluate practice requirements and student progress rates (i.e., readiness to learn) during various phases of UPT by studying UPT grades and other appropriate measures. The primary objective is the establishment of a single UPT data base. The secondary objective is the conduct of statistical investigations on the data base.

The daily flying grades will be obtained from Air Training Command. This data will be formatted for analysis by AFHRL/FT. As a minimum, the data will also include syllabus flight number, maneuver identification, and IP grades. A series of statistical analyses will be performed on the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT

E. Streeter, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF322910; F33615-77-C-0521)

To provide a systematic definition and assessment of optical visual display design approaches for future tactical fighter aircraft employing advanced technology. Durihg FY 77 this contract will provide (1) a planning and technical framework for a phased, multi-year development and evaluation of cockpit design alternatives, and (2) a series of engineering trade-off comparisons among alternative approaches for visual display integration. The need for this effort arises because the quest for reduced cost dictates smaller size vehicles (hence, reduced panel space for cockpit control/display, as typified by the F-16) at the same time that technology can provide an overwhelming amount of flight data and new flight modes previously unavailable, while cockpit designers lack expertise with the interaction of new technologies and resulting impact on the crew. By closing this gap in display integration technology in a near-term applied context emphasizing advanced avionic and flight vehicle state-of-the-art, direct support is provided to ASD TN 72-46 (high acceleration cockpit, control/display definition), the draft requirements TAF-301-73 (advanced tactical fighter) and the AFSC development goals TC-2, 4, 5, and MS-4.

This is one of three parallel contracts aimed at developing better methods and criteria for interfacing tactical aircrews with advanced technology fighter aircraft (i.e., target first operational capability post - 1985). Visual display design alternatives will be derived based upon mission requirements analyses, crew size/function options, and potential (aircraft, avionic, and display system) technology combinations. Engineering trade-off comparisons among the postulated alternatives will determine the incremental impact of specific applications of advanced display technology upon aircrew needs, capabilities and cockpit configurations. Figures of merit used in the trade-off analysis will include performance, safety, survivability and cost. Promising alternative designs will be selected for detailed development and evaluation under a follow-on contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, A BIOLOGICAL WASTE WATER MONITOR STUDY USING DIFFERENTIAL LASER LIGHT SCATTERING FROM BACTERIA

P.J. Wyatt, Science Spectrum Inc., *1216 State St., Santa Barbara, California* 93105 (DF053030; F49620-78-C-0096)

AF function - the Air Force uses a variety of chemicals in its daily operations. These chemicals may provide detrimental impact to surrounding environments and/or be toxic to humans and other life forms. Recent legislation mandates that the Air Force assess the toxicity of the unique chemicals it uses and be responsible for assessing and controlling pollution in its operations. Deficiency - rapid and accurate methods for pollution monitoring and toxicological assessment are required to replace the time-consuming and costly techniques presently employed. Objective - the objective of this research is to provide basic data necessary for the development of a rapid bioassay method for monitoring toxicants. How research contributes - this work should provide needed data on the applicability of bacteria as monitors of toxicants from any liquid effluent and contributes directly to subarea 1.9, "environmental protection and toxicological hazards."

The investigators will measure dose-response curves for several bacterial strains as a function of toxicant concentration. The toxicants studied will include missile propellants (hydrazines), jet fuels, nitrosodimethylamine and various phenolics of Air Force interest. Basic studies to quantitate the effect of the various toxicants on growth rates, morphologies, sizes and size distribution of bacterial cells will also be undertaken. Research to identify bacteria best suited for the detection of specific toxicants will be initiated. Effects on two component mixed cultures will be studied for at least two different toxicants. Application of results for the development of a rapid screening method for toxicants will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, DUMMY AND HUMAN PARACHUTIST RESPONSE COMPARISONS

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895414)

(1) To permit dummy test data to be used more knowledgeably in evaluating parachutes with regard to human injury. (2) To better define and verify physiological tolerance limits during parachute opening. (3) To identify shortcomings in existing instrumented dummies, and to specify critical requirements to be addressed in developing improved dummies to evaluate human injury potential during parachute opening.

Parachute opening tests will be conducted using anthropomorphic dummies instrumented to obtain tri-axial linear acceleration and rotational rate data to compare with data accrued from live jumpers and with data from previous tests using similar dummies. Test conditions will be identical to the conditions used for separately funded concurrent live human subject tests. Analyses will be performed to identify the response differences between existing dummies and live subjects, and to develop a method with which to determine the probability of exceeding given acceleration limits for given airspeed ranges and parachute configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

6.0005, TOXIC HAZARDS RESEARCH - ENVIRONMENTAL TOXICOLOGY

T.T. Crocker, University of California, Irvine Campus, California College of Medicine, Dept. of Community & Environmental Medicine, *Irvine, California* 92664 (DF319590; F33615-76-C-5005)

This program will provide specific data and knowledge on the toxic properties of new materials, propellants, and other atmospheric contaminants used or encountered by Air Force personnel in the development, test, and operational phases of new aeronautical, aerospace, missile, and orbital systems. The results of this program, in conjunction with the over-all toxicology program, will provide the Air Force and other governmental agencies with tolerance criteria to provide for the optimum protection of Air Force and other Department of Defense personnel. Pertinent toxicological information will provide guidance to design engineers in order to develop aeronautical, aerospace vehicles, and launch systems with maximum functional capability. Results will also be used for the development of design criteria for pollution abatement procedures and equipment.

The contractor shall maintain and operate the toxic hazards research unit and conduct toxicological research on a wide variety of current and advanced USAF research and development materials. Emphasis is upon the applied inhalation research area. The spectrum of occupational inhalation exposures that will be investigated begins with accidental, short-term, high-level exposures, include occupational, daily, 8-hour, industrial exposure, and culminates in truly uninterrupted, long-term continuous exposure as experienced during confinement in sealed habitable atmospheres. In addition, the effort shall provide definitive data concerning the environmental impact of selected Air Force materials through the use of representative aquatic and plant species. This R & D effort to develop environmental pollution toxici-

ty criteria for Air Force chemicals is a firm AFSC requirement as outlined in AFR 19-1 and AFR 19-2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, PREDICTING MOTIVATIONAL CHANGE AND AERONAUTICAL ADAPTABILITY AMONG NAVY AND MARINE CORPS AVIATION TRAINEES

R.E. Dull, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN141807)

Past research and development has supplied the means of reducing attrition from undergraduate pilot training and identifying poor training risks at relatively early points in training. There still exists, however, a significant attrition rate in which about half can be associated with motivation and aeronautical adaptability. Part of this attrition can be attributed to individual idiosyncratic characteristics yet to be measured and part to the impact of external change or lack thereof in the applicant/trainee population. The objective of this work unit is to develop improved methods for measuring and predicting motivational change and aeronautical adaptability as related to attrition from and performance in training and operations.

Together with present measures of cognitive aptitude and interest in flying, new measures of aptitude, attitude, and personality will be assessed, separately and in combination, for prediction validity against attrition from and performance in different stages and pipelines of naval air training, and ultimately against fleet criteria. The effects of identifiable cultural and organizational factors upon attrition will be examined.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0007, VISUAL ACQUISITION FUNCTIONS IN OPERATIONAL ENVIRONMENTS

J.E. Goodson, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN477112)

The current state of knowledge concerning the relationship between specific visual functions and the performance of operational tasks is critically deficient. New information is required in order to identify visual requirements for screening and/or training of aviation personnel, and to develop more effective criteria for human factors design requirements in operational systems. Further, the visual system is known to be sensitive to stressful conditions encountered in the operational environment. Data are not available for predicting or assessing the effects of environmental variables upon mission limiting visual functions. The objectives of this work unit are to define critical visual requirements in naval aviation, and to assess visual capabilities in the aviation community for meeting these requirements.

This exploratory development work will extend and apply the data of coordinated work unit sponsored by OPNAV and AIRSYSCOM. The relationships of existing visual tests to aviation performance requirements will be investigated. Psychophysical and physiological techniques will be utilized to develop new methods of assessing visual capabilities. Emphasis will be placed upon dynamic visual functions which currently are not being tested, and upon stimulus conditions which reflect conditions of the aviation environment. As methods are developed for assessing visual characteristics which are important to operational performance, these will be applied to determine distribution among naval aviation personnel, and to derive new visual screening requirements.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0008, DIVIDED ATTENTION AND TASK WORKLOAD IN CONTROL FAILURE DETECTION AND DECISION-MAKING IN AVIATION SYSTEMS

C.D. Wickens, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DF049320; AFOSR-77-3380)

AF function - the role of attentional processes in flight control has assumed an increasingly important position in aviation and man-machine systems research because of increased complexity of weapon systems and aircraft missions. Deficiency - accordingly, it is critical to better define the pilot's attention capacities and limitations for purposes of enhancing the probability of mission effectiveness. Objective -attention allocation processes as they affect pilot operator performance under varying task loads and in relation to monitoring vs control functions will be modeled to elucidate understanding of the interrelationships. How research contributes - a major contribution of the proposed research to real-world aviation problems is anticipated to be the provision of a theoretical basis for predicting the consequences of adding different operator requirements in the design of new systems.

Employing a latency based theory of signal detection, the research will model the operator's performance in detecting and responding to changes (failures) in the dynamics of simulated aircraft systems. performance as a function of operator monitoring vs operator controlling functions will be examined, and conclusions will be drawn concerning the appropriateness of one mode vs the other. Also, the effects of divided attention on tracking performance using control theory analysis will be investigated and an attempt will be made to model the dynamic characteristics of attention allocation as the operator is required to respond to increasing or decreasing task demands in the dual task environment. Application of the results will be explored concerning (1) on-line monitoring of attention, and (2) attention allocation ability as a predictor of flight training success.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, OPERATOR WORKLOAD MEASUREMENT

Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts 02139* (OS-70055; OS161037 (TRAIS NO.))

The proposed research has the following objectives: 1) The selection of candidate workload measures for pilots through analysis, modeling, and experimentation. 2) The validation of the effectiveness of these measures in a simulated full workload environment for IFR piloting.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary of Transportation

6.0010, INVESTIGATION OF SIGNAL ANALYSIS TECHNIQUES FOR ECG/VCG CLASSIFICATION

D.E. Gustafson, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DF320400; F33615-77-C-0606)

Over the past four years, computer algorithms have been developed for digitizing and preprocessing vectorcardiograms (VCG), compressing the data so that it can be efficiently transmitted via commercial grade telephone lines, and classifying VCGs into normal and a selected set of abnormal categories. In addition, computer algorithms have been developed for detecting and identifying various categories of arrhythmias. These algorithms have been assembled into a prototype version of an overall VCG interpretation system which is operational on the USAF San Antonio Data Services Center (USAFSADSC) IBM 360-65 computer. The objective of this effort is to extend the currently utilized algorithms and to develop new algorithms for interpretation of VCGs based on experience gained with the operational prototype VCG interpretation system. This is an extension of the work done under 77550112.

Algorithms developed for detecting and classifying arrhythmias via R-R intervals will be extended to include P-R intervals. KI expansions will be performed separately on the P and QRST segments of VCGs. Investigations of the tendency of VCG pattern vectors to cluster in feature space will continue. Com-

puter algorithms will be developed for calculating the eigenvalues and eigenvectors of large matrices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0011, HIGHER ORDER LANGUAGES FOR FLIGHT SIMULATOR PROGRAMS

J. Goodenough, Softech Inc., *460 Totten Pond Rd., Waltham, Massachusetts* 02154 (DF228150; F33615-77-C-0029)

To investigate the problems in and approaches to developing a higher order language (HOL) for standard use in future Air Force simulators. The work will result in a thorough programming analysis of flight simulation problems and use of this analysis to develop and evaluate alternative programming approaches. This will give the Air Force the technology necessary to increase the efficiency of its programming in future simulations.

A technique will be developed that can be used to analyze large scale programming problems to determine what programming and information processing features are required. This technique will then be applied to perform a detailed analysis of the programming of modern flight training simulators. Specifications for an ideal simulation higher order language will be developed, and existing higher order languages will be evaluated. Modifications required to make the most suitable existing languages of maximum use in simulation will be determined. Alternative approaches to implementing a standard HOL will be identified and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, NUTRITIONAL EDUCATION - A BASIC NUTRITION COURSE FOR AIR FORCE PERSONNEL

O. Maller, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4364)

To develop and evaluate a prototypic basic nutrition education course designed for AF personnel to be used in basic training, flight training programs and base level nutrition. This course should be designed so as to be of use for the Reserve, National Guard and the dependents of military personnel. The course will be directed at preventing malnutrition as a consequence of following fad diets or overnutrition by developing poor eating and activity habits.

Assess current level of nutritional knowledge and practices in a target population of AF personnel. Design and implement a program of nutrional intervention. Retest target population and appropriate control groups to evaluate efficacy of the intervention.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

6.0013, IDENTIFICATION AND QUANTIFICATION OF WATER SOLUBLE COMPONENTS OF JP4

J.D. Brammer, North Dakota State University, School of Science & Mathematics, Dept. of Zoology, *Fargo, North Dakota* 58102 (DF053550; AFOSR-78-3709)

AF function - the Air Force consumes 225,000 barrels of JP-4 each day. Transport of this fuel, as well as routine operations have resulted in the contamination of aquatic environments with JP-4. Water-soluble components of this jet fuel may affect man through drinking water supplies, accumulate in food chains and be detrimental to aquatic ecosystems. Deficiency - little information is available on the biological and environmental fate of water-soluble components of JP-4. Objective - the objective of this research is to identify and quantify the water-soluble components of JP-4 and to determine the biological effects of those constituents on aquatic biota. How research contributes - results of this study will provide information necessary to establish realistic guidelines regarding release of JP-4 into aquatic ecosystems. This research directly supports Subarea 1.9, 'Environmental Protection and Toxicological Hazards' and RO's 1.9.1, 'Health Effects' and 1.9.5, 'Predictions of Environmental Impact'.

Water-soluble components of JP-4 will be identified. Quantitative measurements of individual components will be made over time under different water salinities, temperatures and states of physical agitation. Acute toxicity tests using individual components will be conducted using selected freshwater organisms. Biological effects of sublethal exposures will be measured. Uptake, accumulation and depuration of JP-4 components will be examined in selected aquatic species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, BODY SIZE AND MASS OF AF PERSONNEL

C.E. Clauser, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320940)

To describe body-size distributions of AF personnel for (1) guiding the design, sizing, and procurement of personal-protective equipment and clothing and the layout of workstations, (2) establishing relationships between body-size and injuries incurred upon ejection, and (3) developing human mass distribution and body-size criteria for the design of human analogues required to simulate the body's response to impact, ejection and windblast forces.

The anthropometric data base of USAF men and women required for guiding the design, sizing, and procurement of personal-protective equipment and clothing will be updated in FY 77 for establishing relationships between body-size and injuries incurred during the ejection sequence. In FY 77 and 78, advantages will be taken of recently developed biostereometric techniques to determine for the first time mass distribution characteristics of a sufficient number of living human beings to be able to describe variability of these parameters in the USAF male population. Emphasis is placed upon developing procedures for improving the efficacy with which anthropometric data can be applied to the design of AF systems and equipment. This effort was formerly documented under work units 71840803 and 71840807.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, DIRECT VISUAL MECHANISMS OF NON-DESTRUCTIVE COUNTERMEASURES

R.D. Odonnell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321090)

To develop and assess countermeasures against the human operator in representative threat systems which involve interference, deception, or neutralization of the visual system. To identify a large number of potential countermeasures, and to carry out a systematic, minimal-cost series of evaluations designed to eliminate low probability concepts and isolate those with a high probability of success. To refine these concepts, maximizing their effectiveness, until sufficient testing has been done to deliver the concept to operational development. This work unit supports AFSC development goals SO-5, TC-5, and TC-8.

Candidate countermeasures will be identified through study of the fundamentals of visual mechanisms, and will be subjected to a series of increasingly more high-fidelity evaluations. In the first stage, a conceptual evaluation will be done to estimate the probability of visual confusion. Secondly, laboratory evaluations will be carried out on the basic mechanism concept. Third, combined laboratory/field evaluations will be performed. Finally, where justified, high fidelity simulator and/or field tests will be carried out. Initial concept ideas, and the confusability matrices necessary for conceptual evaluation will be derived from complementary programs in AMRL. Laboratory facilities for carrying out the second level of evaluation presently includes an image metric capability, a laboratory for assessment of visual perception, a five-channel Maxwellian view optical system, and a sophisticated eye tracking system. Capability for novel psychophysical and psychophysiological evaluations are being developed. A mobile laboratory system capable of tracking real aircraft, and of simulating a broad range of countermeasures, will be placed in operational use in order to carry out the third level of evaluation. Other programs in AMRL are developing high fidelity simulators and a metric for quantification of the threat environment. Sug-

gested countermeasures concepts may enter the evaluation sequence at any level, depending on their previous level of investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, IMPLEMENTATION OF ANSI SPECIFICATION S3.19-1974, PERSONAL HEARING PROTECTIVE DEVICES FOR USE IN NOISE ENVIRONMENTS

M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321310)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous noise environments. Military specification Mil-P-38268A specifies the procedures employed to evaluate hearing protectors, and requires the use of the ANSI real-ear attenuation at threshold (REAT) method for the evaluations. The American National Standards Institute (ANSI) has recently revised the standard relevant to the REAT method. To maintain compliance with Mil-P-38268A, it is the objective of this work unit to procure and assemble the items necessary to implement the new measurement instrumentation and test methodology for use under 72310338.

Requirements necessary to implement the new standard will be identified, including specification of the instrumentation needed to generate the test signals and record the subjects' responses. A survey will be made of existing facilities to determine whether modifications of these facilities will be required, as well as to determine possible requirements to procure additional instrumentation. When the necessary equipment is available it will be assembled into an instrument console adjacent to the test room. Completion of this assembly will permit this laboratory to initiate hearing protector evaluations using the ANSI S3.19-1974 standard. Software will be developed to present the data in forms consistent with current methods and standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, TIMING OF G-PROTECTIVE TECHNIQUES

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, Warminster, Pennsylvania 18974 (DN881475)

To determine the single and combined effects of the timing of three g-protective techniques, namely seat supination, the M1 maneuver and inflation of the anti-g suit on subsequent human g tolerance.

Five relaxed and restrained subjects shall be exposed to increasing g loading on the dynamic flight simulator while seated in a mechanized supinating seat. Each of three g-protective techniques shall be separately evaluated with respect to the timing of its initiation on subsequent g tolerance as judged by peripheral light loss (PLL) and/or reversal of blood flow in the superficial temporal artery. Once time relationships for each of the three techniques with respect to time of g onset have been established the time relationships for combinations of two techniques and for the combination of all three techniques shall be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

6.0018, TECHNIQUES FOR ASSESSING G-RELATED PATHOLOGY IN PILOTS OF HIGH-PERFORMANCE AIRCRAFT

E.B. Smith, Technology Inc., *Houston, Texas* (DF323760; F33615-78-C-0614)

The myocardial infarctions that go unrecognized each year in the general population and the cardiomyopathy and subendocardial hemorrhage detected recently in swine exposed to acceleration stress make it imperative to develop a diagnostic tool to detect this damage if it exists in aircrew members of high-performance aircraft. An analytical biochemical technique that correlates with myocardial injury will be developed.

The experimental protocol of this task is divided into four parts: (1) select the most appropriate analytical method for serum creatine phosphokinase isoenzymes and other chemical indicators to validate myocardial injury, (2) correlate laboratory induced myocardial injury with these selected chemical indicators, (3) correlate myocardial damage resulting from plus GZ acceleration stress as in part 2, and (4) compare changes in isoenzymes concentrations in human subjects exposed to plus GZ acceleration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, RADIATION PRODUCED BRAIN INJURY - AIRCREW PERFORMANCE DECREMENT

D.E. Cordts, U.S. Dept. of Defense, Air Force, School of *Aerospace Medicine, Brooks Air Force Base, San Antonio, Texas* 78235 (DF312190)

Performance decrement has been consistently observed in trained primates exposed to weapons radiation. Since performance is dependent on the central nervous system (CNS), a temporary loss of consciousness and/or alteration of brain function can result in mission failure. This effort will investigate radiation injury to the brain and to systems supporting the brain.

Strong presumptive evidence exists that diminished cardiovascular capacity leading to diminished blood flow to the brain is a major factor in radiation induced decrement. Since flight maneuvers involve g stress, and g stress also affects the cardiovascular system, there is a need to study these combined factors. Rats will be evaluated for the effects of radiation plus g versus g alone. The parameters will be EEG, ECG, and heart rate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, USAF HEARING CONSERVATION PROGRAM

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Many USAF weapon systems and support operations represent potential risk to the hearing of both military and civilian personnel. Loss of highly trained personnel and compensation for hearing loss continue to be major AF problems. The primary objective of this effort is to monitor the USAF hearing conservation program, specifically as defined in AFR 161-35. The prevention of noise induced hearing loss among AF members requires that these personnel be included in a comprehensive hearing conservation program and the purpose of this research is to guarantee that the multifarious elements of the program are effective. Also, research will be performed to validate auditory risk limits, determine the effectiveness of personal ear protection devices and noise control measures, and insure adequacy of criteria and procedures for disposition of noise-exposed personnel who demonstrate shifts in hearing. Many aspects of the R & D efforts have potential for direct operational support of hearing conservation programs in the field. The tasks described in the Management Review, 1-2 May 78, along with the milestone elements can be defined and transferred to OEHL. This work will then continue as a pure R & D effort.

AF forms 1490/1491 and associated documents received at the USAF hearing conservation data registry will receive quality control and then be processed by automated techniques. Computer readouts on a routine basis will be used to continually appraise and evaluate the effectiveness of the overall hearing conservation program. The effectiveness of different elements (military or civilian) at a single base will be continually appraised. Instrumentation utilized in monitoring audiometry, personal ear protection, and disposition procedures for personnel who demonstrate shifts will be assessed on a continuing basis. Methods and techniques used to monitor individuals exposed to potentially hazardous noise will also be continually evaluated and deficiencies, once identified, will be carefully studied so that corrective action(s) can be recommended. Auditory acuity of various groups and subgroups of personnel who work in noise will be studied. Recommendations for correction of problem areas will be made to command surgeons and HQ USAF/SGP, as appropriate. Current plan is for OEHL to acquire all aspects of operational support (MFP8) by March, 1980. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, CLINICAL STUDY GROUPS/CARDIOVASCULAR CRITERIA FOR AIRCREW SELECTION AND RETENTION
D. Hickman, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321590)

Minimize the number of flyers who must be grounded because of the presence of circulatory and respiratory disease. It will be necessary that the significance of the abnormal response to testing procedures in regard to flying performance and safety be better quantified. This effort will accomplish this by establishing the functional and prognostic nature of abnormalities through long-term followup employing newly developed measurement techniques.

Approaches will be developed to allow more precise evaluation of cardiovascular functional integrity and capability in the presence of abnormalities to allow retention of more crewmen in flying duties than previously possible. Techniques will be developed to improve the ability to detect potential problematic disease earlier and permit a more productive preventive approach. Longitudinal studies to assess the significance of disease in aerospace operations coupled with the intensive study of patient groups with specific problems (e.g., acquired bundle branch block) will yield definitive information to help formulate or modify medical standards for aircrew selection and retention. Work was formerly documented under work unit 7755-01-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, EVALUATION OF HIGH-ALTITUDE PROTECTION TECHNOLOGY
R.W. Krutz, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322630)

The advent of advanced concept fighter and multi-role combat aircraft has both broadened the spectrum of hazards to which aircrew are potentially exposed and led to a convergence of crew-protective philosophies among NATO allies. The US, Britain, and Canada all share requirements to protect aircrew during high-altitude intercept, reconnaissance, or weapons delivery roles. However, only outdated, cumbersome and often dangerously compromising gear, using a variety of protective concepts and equipment combinations, is available for such needs. To assure the observance of critical minimum protective standards, Working Party 61 (of the Air Standardization Coordinating Committee) has ratified Air Std. 61-011, a document which defines pressure-garment design and use criteria. To assure compliance with such guidance, together with developing a data base useful in updating/revising present recommendations, this effort will provide for continuing tri-nation cooperation in evaluation of available altitude protection technology. Previous work in this area has been documented under work unit 7164-11-01, the present work unit has been established by direction of HQ AMD to implement a new technology planning objective.

This organization has established appropriate liaison with the RAF Institute of Aviation Medicine (IAM) and Canada's Defense and Civil Institute of Environmental Medicine (DCIEM). Cooperative evaluation of selected in-service prototype garments will be conducted with test responsibilities divided among participants in a manner taking best advantage of the facilities/expertise available within each organization. Data obtained from tests of flying gear will be used to assess its compliance with existing guidance, determine suitability for use in specific flying roles and from a data base useful in future equipment design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, TREATMENT OF AIRSICKNESS IN AIRCREW UTILIZING BIOFEEDBACK TRAINING, AUTOGENIC TRAINING, AND PSYCHOTHERAPY
R.A. Lvey, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324340)

Develop a cost-effective treatment program for rehabilitating airsick aircrew, without using medication, utilizing self-monitoring physiological instrumentation, autogenic training and psychotherapy.

USAF aircrew with operationally significant airsickness may be referred to USAFSAM Aeromedical Consultation Service for evaluation and consideration for the rehabilitation study. If found medically and psychiatrically fit, they will undergo a regimen of biofeedback conditioning, autogenic training and psychotherapy (as required). Upon completion of the program they will be returned for an immediate operational trial.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, DEVELOPMENT OF A VARIABLE G-SENSITIVE POSITIVE PRESSURE REGULATOR
R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323540)

To design, fabricate and test experimental g-sensitive positive pressure breathing (PPB) regulators which may be used to improve aircrews plus-GZ tolerance.

Several types of positive pressure breathing (PPB) regulators will be designed, fabricated, and tested in order to determine the optimum PPB relationship to onset of g and the g of the aerial combat maneuver. The first regulator will be designed, fabricated, and tested in-house and will be capable of infinite variability relative to PPB and the g environment. This variable experimental regulator will be used in work unit 7930-12-11 in order to define the best PPB relationship to g. Further PPB regulator development will include design of regulators with other controls (i.e., fluidics and mechanical) and refinement of the electronic PPB regulator to a flight worthy model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, STRESS/WORKLOAD CRITERIA FOR EVALUATION OF IMPROVED AIRCRAFT INSTRUMENTATION
W.F. Storm, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319930)

The objectives of this work unit are to (a) quantify the relationships between psychobiological/biochemical indices of fatigue and stress with pilot performance during missions/sorties systematically varying in workload, (b) document pilot acceptance of new aircraft instrumentation, and (c) quantify the relationship between inflight electrocardiograms and behavioral/biochemical measures for identical maneuvers flown in different modes.

Establishing the correlation between psychobiological indices of fatigue and stress with pilot performance parameters developed by the instrument flight center (IFC) will form a data base for future predictions of pilot fatigue during short duration missions. The analysis of changes in psychobiological measures during identical missions with different instruments/conditions provides an additional parameter for evaluation of instrument effectiveness. Portions of this effort were documented previously under 7930-09-11 and 7930-10-07.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, CONTACT LENSES AND KERATOCONUS
T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected USAF aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this

form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level flight surgeons' offices Air Force-wide and to a lesser extent from MAJCOM and HQ USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CORTISOL RISK FUNCTION

R.G. Troxler, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321810)

Since aircrew with positive coronary angiograms were found to have increased plasma cortisol, the objective is to determine if plasma cortisol is a true risk factor for coronary artery disease.

Measure cortisol routinely on all patients. Compare cortisol as a predictor to predictors used in Framingham formula. Administer cortisol to monkeys in an attempt to see if cortisol induces atherosclerosis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, LIMITS FOR BREATHING GAS MIXTURES FOR AIRCRAFT COMBAT MANEUVERING ENVIRONMENTS

J.E. Whinnery, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322270)

Human volunteer subjects will be exposed to various levels of acceleration stress while inspiring gas mixtures containing various concentrations of oxygen and nitrogen. The responses of the respiratory system will be examined and analyzed to determine the degree of physiologic change imposed by these combined stresses. Data will include, but not be limited to, effects of pulmonary compliance, pulmonary resistance, tidal volume, frequency of breathing, and pulmonary ventilation. New methods utilizing nuclear medicine techniques for determination of ventilation and perfusion will be developed first using a miniature swine model and when refined will be used on human volunteer subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0029, EFFECTS OF COMBINED STRESSES OF AF OPERATIONS AND MEDICATION ON CARDIOVASCULAR AND NERVOUS FUNCTIONS

A.H. Briggs, University of Texas, Health Science Center at San Antonio, South Texas Medical School, Dept. of Pharmacology, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (DF026870; AFOSR-76-3029)

AF function - AF operations involve a wide range of aircraft and related weapons systems which may impose abnormal levels of stress on human operators due to extremes in temperature, pressure, acceleration, vibration and breathable atmospheres. The circulatory and nervous systems are early to be affected by such challenges and their responses are in many cases unknown as to time of onset and degree of application. Deficiency - there is a need for updated technology to protect the human operator from such environmental extremes and/or to extend operator tolerance and performance. Objective - this research seeks to develop an understanding of discrete basic mechanisms of circulatory and nervous system adaptation to stresses encountered in an AF operational environment. How research contributes - this research directly supports task 2312A3 and, indirectly, other tasks in the life sciences technical area.

Five research efforts will be pursued which closely complement and support research and exploratory development efforts on-going at USAFSAM and AMRL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTER AIDED GEOMETRIC DESIGN

G.M. Nielson, Arizona State University, School of Liberal Arts, Dept. of Mathematics, *Tempe, Arizona* 85281 (DN223592; N00014-75-C-0244)

The purpose of this research is to devise new ways of approximating shapes (mathematical functions) used to define curves and surfaces in the process of computer aided geometric design (CAGD). CAGD is already used to design a wide variety of Navy vehicles (e.g., it is used to design aircraft and shop exteriors). CAGD can be extended to design almost every mechanical component of naval vehicles and weapons. This extension depends upon the development of new fundamental tools for representing shapes; tools must be developed which allow the designer to carry out his intention without worrying about mathematical details of the representation.

This research will pursue techniques for approximating (primarily multivariate) functions. The search for new techniques will concentrate on two qualities. First, new ways of determining the approximates must be developed in order to given the designer-user flexibility and control. The traditional ways of determining approximates, e.g., interpolation, do not work in a design context. Secondly, the approximates should be definable over fairly complex domains, not just rectangular polygons. Also, emphasis will be placed on approximates which can be calculated easily. Ease of calculation is often critical for computer graphics applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, A PDP 11/55 COMPUTER FOR THE LOWELL OBSERVATORY

O.G. Franz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST7821671)

This grant partially supports the purchase of a new computer for scientific computation and analysis of data from modern, efficient detector systems in use at Lowell Observatory.

The new computer will be used in support of Lowell Observatory's entire research program, which includes not only the work of its own scientific staff of ten full-time astronomers, but also the activities of the 60 to 70 quest investigators from the United States and from abroad who annually use the Observatory's research facilities.

Observational programs now in progress or in preparation encompass virtually the entire field of optical astronomy; investigations of the physical properties of asteroids, comets, planets, and satellites; studies of the colors, brightnesses, surface temperatures, diameters, masses, motions, and distances of stars; research on the distribution and chemical composition of interstellar material; investigations concerning the properties and the nature of quasi-stellar objects; and studies of faint, distant galaxies. This research bears directly on questions concerning the nature, age, origin, and evolution of the observable universe.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

7.0003, MATHEMATICAL THEORY OF NONLINEAR WAVE PROPAGATION

G.B. Whitham, California Inst. of Technology, Graduate School, Dept. of Applied Mathematics, *1201 E. California Blvd., Pasadena, California* 91109 (DN525213; N00014-75-C-0702)

The mathematical research being done under this task responds to naval requirements for prediction and control of physical phenomena in the fields of oceanography, meteorology, gas dynamics and plasma physics. The mathematical theory of nonlinear wave propagation is particularly relevant to naval research in oceanography. This work provides fundamental insight into the propagation of both internal and surface waves and water waves on a beach.

Research is being done in the mathematical theory of nonlinear wave propagation and related problems in the general theory of partial differential equations. This work includes the investigation of variational principles for nonlinear wave problems and the study of the general mathematical structure of partial differential equations derivable from variational principles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0004, NUMERICAL TECHNIQUES FOR OPTIMIZATION AND SYSTEMS OF NONLINEAR EQUATIONS

P.S. Jensen, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (DF044770; F49620-76-C-0003)

AF function - design of aerospace vehicles. Deficiency - no effective analytical and computational methods are available for optimizing the complex structures used in the bodies and parts of aerospace vehicles. Objective - to develop, implement and test efficient algorithms for global optimization and the solution of nonlinear systems of equations. How work contributes - computer codes for use in the design of structures will be developed under this effort.

Algorithms for optimization and the solution of systems of nonlinear equations will be developed, implemented as computer programs, tested and documented. The emphasis of the effort on optimization will be on algorithms for achieving global rather than local optima. The emphasis of the effort on the solution of nonlinear systems will be on algorithms appropriate for use in the integration of stiff oscillatory problems. Methods suitable for broad application will be sought rather than methods that exploit specific problem characteristics, subject to the above emphases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL VORTEX TRACING

O. Buneman, Stanford University, Inst. for Plasma Research, *Stanford, California* 94305 (DN875232; N00014-78-C-0272)

The development of accurate numerical procedures for predicting high Reynolds number flows will lead to improved methods for optimizing the performance of aircraft, ships, and missiles. The purpose of the proposed research on three-dimensional turbulence will be to develop a viable and accurate vortex tracing method which will be able to simulate, for special cases, the evolution of turbulence.

The basic approach of the proposed method is to represent the continuous distribution of vorticity in a flow field by discrete, closed, vortex filaments. In this model, viscous effects will occur only in the internal structure of the vortex filaments. Since viscous effects are neglected elsewhere, the vortex filaments move with the local fluid velocity. The velocity field is not calculated directly from Biot-Savart's Law but by integrating a Poisson equation on an appropriate mesh. Once the velocity field is established, the fluid elements along each vortex filament are advanced in time to establish a new vorticity distribution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0006, MATHEMATICAL FOUNDATIONS OF STABILITY THEORY, CONTROL THEORY AND NUMERICAL LINEAR ALGEBRA

M. Marcus, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Mathematics, *Santa Barbara, California* 93106 (DF046720; F49620-78-C-0030)

AF function - the design of efficient and stable control systems for future aircraft engines, missile motors, aircraft control surfaces. Deficiencies - the stability on nonlinear as well as some linear control systems are not well understood. Objective - this research will study the stability theory for systems of ordinary differential equations that describe any dynamical system. How work contributes - results may be obtained which may aid the designer of control systems for future aerospace vehicles.

Under this block contract the following topics will be investigated: (1) eigenvalue location and the numerical range, (2) the relationship between eigenvalues and entries of a finite matrix, inequalities for eigenvalues of sum and products, (3) eigenvalue theory for matrices with non-negative entries, (4) control theory applications of matrix theory and eigenvalue localization theory, eigenvector and eigenvalue computing methods, and (5) exact matrix and combinatorial computations on the ILLIAC 4. In addition, the computerized linear algebra bibliography will be updated and searches requested by AF laboratories will be honored on a time-available basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, RIGOROUS DIFFRACTION THEORY SCATTERING FOR APPLICATION

R.E. Kleinman, University of Delaware, School of Arts & Sciences, Dept. of Mathematics, *Newark, Delaware* 19711 (DF038150; AFOSR-74-2634)

AF function - radar target recognition. Opportunity - target vibration effects radar return. Objective - analytical relations between target eigenmodes and the radar return. How work contributes - engine vibration aerodynamic flutter, etc., characteristics, if determinable from the radar return, would improve target recognition capabilities.

A simplified model for scattering from vibrating bodies will be derived mathematically using asymptotic techniques and tested against experimental data. Other research areas being continued include application of optimal control methods to impedance loading problems in order to find that loading or induced current distribution on a surface which optimizes a desired scattering or radiation characteristic, and extension of integral equation scattering techniques to higher frequencies and non-smooth boundaries in ways suitable for efficient numerical solution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, FIRST PASSAGE TIMES IN STOCHASTIC DIFFERENTIAL EQUATIONS OF MATHEMATICAL PHYSICS AND ENGINEERING

B.J. Matkowsky, Northwestern University, Evanston Campus, Technological Inst., Dept. of Engineering Science & Applied Mathematics, *633 Clark St., Evanston, Illinois* 60201 (DF051910; AFOSR-78-3602)

AF function - improve the reliability of aerospace vehicle structures. Opportunity - an analysis technique newly developed by the author promises results in AF relevant reliability problems. Objective - new insight into control of reliability in physical structures. How work contributes - by suggestive examples exhibiting and quantifying relevant non-intuitive effects.

Matched asymptotics are used to study small stochastic perturbation of deterministic problems involving multiple turning points and equilibria. Probability of passage from one equilibrium to another, position of inner "boundary" layers occurring in "resonance", expected exit times or points, etc., are to be determined as appropriate for problems including dynamic stability of structures, electrical network stability under thermal noise, determining rate coefficient in chemical reactions, and atomic migration in crystals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS
A. Nachman, Texas A & M University, College Station Campus, School of Science, Dept. of Mathematics, *College Station, Texas* 77843 (DF048270; AFOSR-77-3290)

AF function - engineering intuition relating to tire impact on a runway, composite bonding, etc. Deficiency - mathematical techniques and solutions for power law viscoelastic materials. Objective - solution of two-dimensional time-dependent contact and fracture problems. How work contributes - by suggestive examples, exhibiting and quantifying relevant non-intuitive effects.

The motion of a crack tip in a power law viscoelastic layer important to bonding, Shallamach waves of detachment for a sliding tire over pavement, etc., will be investigated by reduction to a coupled system of dual relation problems or integral equations. Mathematical techniques used include Fourier and Mellin transforms, Abel integral equation solutions, and other techniques used on Cauchy integral equations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ION PHOTOFRAGMENT SPECTROSCOPY POTENTIAL SURFACES OF MOLECULAR IONS
J.T. Moseley, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF043690; F44620-76-C-0095)

AF function - Air Force operations in reconnaissance, communications, detection and discrimination require understanding of complex atomic, molecular and ionic phenomena that occur in the natural and disturbed atmosphere. Deficiency - there is a lack of sufficient quality information on fundamental processes that occur in the atmosphere that affect electron densities, which hinder propagation of electromagnetic signals in the presence of perturbed atmosphere backgrounds. Objective - investigate the energy and angular distributions of photofragment ions from parent molecular ions important in the atmosphere and interpret experimental results in terms of the parent ion molecular potentials and structural properties. Examine and interpret photodetachment cross-sections if important in these ions. How work contributes - provides a measure of ion and electron densities in the normal and disturbed atmosphere which affect communication signals. Also important in the development of high energy lasers.

Use of laser and a fast ion beam apparatus termed the coaxial-beam photofragment spectrometer to produce photofragmentation of polyatomic atmospheric ions and other ions of interest. Determine photofragment energy and angular distributions to establish the structural properties of the ions. If important, interpret results of photodetachment cross-section investigations in terms of vertical detachment energies and electron affinities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, THEORETICAL ASPECTS OF SUPERCONDUCTOR BEHAVIOR
E. Simanek, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502

Theoretical study of the properties of inhomogeneous superconducting films and aggregates of ultrafine metallic particles is planned. Temperature dependence of the order parameter will be calculated from the model of random superconductivity to interpret tunneling studies of Al films. The effects of Josephson coupling between particles in aggregates will be studied. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0003, MANY-BODY SOLID STATE
D.J. Scalapino, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR7617373A02)

Research begun under NSF grant DMR73-07660 will be continued and extended, including studies of the physical properties of pseudo one-dimensional materials and phase transitions and related problems in quantum field theory. Specifically, techniques developed in the previous grant period will be applied to calculations of correlation functions for one-dimensional systems. Microscopic calculation of the parameters that enter the model Hamiltonians will be undertaken. Work on the mapping of a two-dimensional classical field problem into a one-dimensional quantum field theory problem will be pursued. Non-perturbative solutions to these quantum field theories will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, MAGNETIC CRYSTALS WITH WEAK INTERACTIONS
W.P. Wolf, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (DMR7623102A02)

Research previously funded under grant DMR73-02405 will be continued. The work covers several related areas: 1. Experimental studies of multicritical points, including work on tricritical, bicritical and wing critical points. 2. Domain studies near phase transitions. 3. High-frequency relaxation measurements of magnetic specific heats. 4. High-sensitivity magnetometry, development of a SQUID magnetometer. 5. Phonon contributions to bulk magneto-thermodynamic properties, a heat capacity study of non-additive effects. 6. Phase transitions in mixed crystals including mixed antiferromagnetic-ferromagnetic and antiferromagnetic-diamagnetic crystals. 7. Preparation of new magnetic materials, including high-pressure hydrothermal synthesis of rare-earth hydroxides and hydroxy carbonates. The principal objective of all these studies is to seek direct confrontation between theory and experiment, with a view to improving our understanding of the microscopic processes important in magnetic materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, MAGNETICALLY ORDERED MATERIALS AND QUANTAM ELECTRONICS
V.J. Folen, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620115)

To investigate magnetic materials and magnetic quantum electronic phenomena which are essential in the operation and design of practical devices. Such investigations result in the discovery of new magnetic effects and/or in improved magnetic properties which enhance the sophistication, reliability and economic competitiveness of devices for communications, control, sensing, memory, radar, sonar and many other applications needed in the Navy.

Experimental techniques (including magnetization, magnetic susceptibility, magnetoelectric susceptibility, magnetic anisotropy, magnetostriction, optical absorption and resonance) and analysis are utilized on selected magnetic materials and magnetic quantum electronic components in order to study and exploit those phenomena which have the greatest potential for military applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0006, SUPERCONDUCTING MATERIALS AND TECHNOLOGY
D.U. Gubser, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620040)

Determination of basic interactions in solids which control electrical and magnetic properties at cryogenic temperatures, particularly those interactions responsible for the occurrence of superconductivity. Identification of physical and chemical parameters which optimize superconducting properties of a given system.

This program emphasizes the study of alloys and compounds formed by new and unusual fabrication techniques. The magnetic moment, magnetic susceptibility and electrical resistivity of carefully prepared and well characterized sample alloys are studied as functions of temperature, pressure and magnetic field. Data are interpreted in terms of modern theories of their modifications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, MATERIALS PROCESSING OF HIGH TC SUPERCONDUCTORS FOR SYSTEMS APPLICATIONS

R.A. Hein, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680280)

This jointly funded program (ref. WUAS M01-43.701) is to develop to the point of production readiness multifilament V3Ga composite wire for service at higher tempertures, higher magnet fields, and with higher current densities than presently available with commercial Nb-Ti wires. It is to develop processes and fabrication procedures which are amenable to commerical production and to fully characterize the superconducting properties of the wires so produced.

The technology developed at NRL for producing multifilament V3Ga wire will be extended to long lengths of high filament density wire. Measurements of the critical current of V3Ga as functions of temperature, magnetic field, and other important engineering parameters will be compared with similar measurements for Nb3Sn. These data will aid in material optimization and provide options for superconducting systems development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

8.0008, ELECTRONIC STATES OF DEEP LEVEL DEFECTS IN SEMICONDUCTORS

L.A. Hemstreet, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680408)

Deep level defects in semiconductor materials, however produced, have a great effect on the electronic properties of devices. An understanding of the properties of such defects is therefore essential to insure proper design and performance of a broad spectrum of electronic and optoelectronic systems employed by the Navy. The objective of this program is to conduct a systematic theoretical study of various classes of deep level defects in such semiconductor materials as silicon, gallium arsenide, and indium phosphide, and to correlate the behavior of such defects with the local bonding properties of the defect-solid system.

The host solid will be represented by a large cluster of atoms, and realistic self-consistent calclulations of the electronic properties associated with various impurities/lattice defects in the host cluster will be calculated using multiple scattering theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, SOLAR-TERRESTRIAL PHYSICS

D.J. Michels, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880036)

To improve basic understanding of the relationships between geophysical disturbances and the variability of solar plasma and electromagnetic radiations. Improved understanding of the mechanisms that cause disturbances in the earth's magnetic field and the ability to characterize and predict the occurence and severity of such disturbances (geomagnetic storms) is of great importance to the Navy. Essential Navy/DOD systems are affected by geomagnetic anomalies; in some cases geomagnetic activity ranks high among causes of system outage or degradation or as a significant cause of false signatures.

Research emphasis will be on improved understanding of how the solar material is propagated towards earth and on understanding what parameters govern the severity of the geomagnetic response. Solar monitoring experiments will be flown in satellites; collaborative arrangements will be worked out to achieve the multidisciplinary approach required by this problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, TWO- AND THREE-BODY CORRELATIONS IN SIMPLE GASES

J.W. Dufty, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE7822211)

This grant, spported by the Structral Chemistry and Thermodynamics Program, is for theoretical and experimental research on the detailed nature of the forces between pairs and triplets of molecules. These forces contribute significantly to the structure and motion that occurs in the important area of high density gases and liquids. Simple gases, for example, Xe, HCl, and DCl, are chosen because detailed experimental and theoretical studies are tractable.

The research program will use neutron scattering and diffraction experiments, computer simulation experiments, and theoretical analysis to extract detailed two-body and three-body potential energy functions. The central experimental quantity is called the partial structure factor and it can be related to the structural and dynamic properties of the fluid through the use of a theoretical model. The theory of the structure factor itself will also be developd and compared with the experimental results.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, SEMICONDUCTOR OXIDE INTERFACE STATES

C.T. Sah, University of Illinois, Urbana Champaign Campus, Inst. of Aviation, *Willard Airport, Savoy, Illinois* 61874 (DF042160; AFOSR-76-2911)

AF function - Air Force communications, data processing, and remote sensing systems are among the many systems requiring reliable and stable solid state electronic components and devices. Deficiency - silicon is the dominant semiconducting material used in these devices, and the surface states, interface states, and oxide traps exert a controlling influence on the reliability as well as the electrical characteristics of bipolar and MOS field effect transistors. In addition, the two- and three-dimensional electrical properties of semiconductors are becoming increasingly important as the characteristic size in devices is reduced to submicron dimensions. Objective - the objective of this research is to obtain an understanding of the atomic origins and microscopic-macroscopic properties of the interface surfaces and oxide charges on semiconductor surfaces, as well as an understanding of two- and three-dimensional effects which become important at submicron device sizes. How work contributes - the objective will be accomplished by providing a combined experimental/theoretical approach.

Studies will continue on the atomic origin of interface states and oxide charges in silicon MOS structures by means of a) fabrication variations correlated with detailed evaluation of electrical properties. b) studies of the generation, diffusion, and annealing kinetics with ultraviolet light and keV electron beam excitation. A shared multiprogrammer interface between the electron-beam station and the ultraviolet light source setup with the minicomputer will be added. This will automate data acquisition as well as control of experimental conditions. Small geometry effects and defects will be simulated as small device patterns by photo-engraving and measured using the electron-beam presently on hand. Mathematical analysis techniques will be developed to handle the two- and three-dimensional models more accurately than the partially lumped quasi-three-dimensional model developed previously.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0012, NUCLEAR STRUCTURE AND NUCLEAR PROCESSES AT INTERMEDIATE ENERGIES

R.E. Pollard, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (PHY7822774)

The Indiana University Cyclotron Facility provides beams of protons, deutrons, helium ions and other light ions up to an energy of 200 million electron volts, with ancillary equipment and support services to permit a broad range of studies of nuclear structure and nuclear reactions. Research using the facility is carried out by a large community of users from outside the University as well as by large Indiana University groups.

The research performed is in the area of studies of the properties of nuclear ground states and excited states by means of a wide variety of techniques using precisely defined particle beams from the cyclotron and detection devices such as a magnetic spectrometer, solid state detectors and neutron time-of-flight equipment. An active program of studies of pion production near threshold is in progress.

This grant will support the operation of the facility, the continued development of its capabilities, and technical assistance to the full spectrum of users of the facility. It will also provide direct support to the Indiana University users, other users being expected to obtain their support via separate grants from NSF, DOE or other agencies.

This work is a continuation of that supported under Foundation grant PHY76-84033AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0013, CRITICALLY EVALUATED DATA ON OPTICAL AND TRANSPORT PROPERTIES OF SOLIDS

H.H. Li, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DF044030; F44620-76-C-0105)

AF function - weapons, defense. Deficiency - lack of readily available standard reference data on basic solid materials (metals, alloys, refractory compounds) hampers materials development and evaluation for EM radiation resistance. Objective - the goal of this work will be tables of evaluated optical property and electrical resistivity data at high temperatures on selected solid materials of potential importance in laser window and laser-hardened materials technologies. How work contributes - the products of this work will be widely used by design engineers and as input data for a variety of computer programs.

Properties to be first evaluated will be index of infraction and absorption index as functions of wavelength, and the temperature and pressure dependence of both. These will be done for selected families of elements and compounds which may be important in Air Force laser-hardened materials technology. Electrical resistivity and its variation with temperature will be simultaneously reviewed. These results will be accomplished by collecting and organizing all available pertinent experimental data, critically evaluating it, and recommending most probable values. The work of evaluation, and of interpolation and extrapolation, will be aided by the development of improved theoretical or semi-empirical inter-property relationships.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, SURVEILLANCE - X-RAY EMITTED FROM HIGHLY IONIZED ATOMS

B. Curnutte, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (DN323076; N00014-75-C-0490)

This research provides data for developing models for understanding the properties of highly ionized atoms and interactions of these systems with other atomic species. Since these atomic species occur in high temperature plasmas and violent collisions, understanding their properties and interactions is important to the Navy from the standpoint of modeling nuclear weapons detonations with high temperature plasmas, studying solar activity which affects the ionosphere and studying the effects of a nuclear detonation on the environment.

The Lamb shift in O(7-plus) will be determined by measuring the polarization components of the radiation from the Stark-mixed S(1/2) and P(1/2) states. The polarimeters for similar measurements in hydrogen-like silicon and sulfur will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0015, POSITRONIUM EXPERIMENTS

S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (PHY7824702)

Positronium (Ps), the electron-positron bound state, has long been recognized as the ideal 'atom' to be investigated as a test of the quantum electrodynamical theory of atomic systems. However, it has only been recently that the elusive first excited state (n equals 2) of Ps could be observed, and thus lay the ground work for precise testing the 'Lamb shift', i.e., radiative correction measurements.

A program of obtaining high precision measurements of the n equals 2 Ps fine-structure through improved microwave techniques and an investigation of the Ps production phenomena will be continued. The investigation of the Ps emission is aimed at improving the yield of n equals 2 Ps, producing sub-eV Ps emission velocities, as well as carrying out a proposed first direct measurement of the Ps-helium scattering cross-section.

This is the first year of a three-year continuing grant, currently supported under NSF grant PHY76-23883A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, LOW-TEMPERATURE AND NEUTRON PHYSICS STUDIES

C.G. Shull, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139

The neutron spectrometers currently being modernized at the reconstructed MIT Research Reactor will be reinstalled and used for studies in materials characterization and fundamental neutron physics. These studies will be included: further work on the diamagnetization structure of bismuth, de Haas--van Alphen scattering effects, and neutron interferometry development and uses. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0017, RADIATION PHYSICAL CONSEQUENCES OF CHARGED PARTICLES INTERACTING WITH ATOMIC AND MOLECULAR SYSTEMS (DOD 1338.10M)

C.P. Wang, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0G4323)

To study the primary interactions during the passage of charged particles (protons, electrons, etc.) through matter. Such studies are important to the radiation preservation of food since these fundamental processes determine essentially all the physics and chemistry during food irradiation.

The interactions between incoming charged particles and atoms and molecules of target material manifest themselves most clearly in slowing down of incoming particles with accompanying excitation and ionization of target atoms and molecules, the ejection of secondary electrons and emission of Cerenkov light. An accurate description of stopping power necessarily contains knowledge of interactions and structure of atomic and molecular systems. Investigations will study the stopping power of those materials relevant to food irradiation.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

8.0018, RESEARCH WITH HEAVY IONS USING A 500 MEV SUPERCONDUCTING CYCLOTRON

H.G. Blosser, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (PHY7822696)

This grant will provide support for a research program in nuclear science at Michigan State University. In addition to continuation of light-ion work using the 50 MeV cyclotron constructed under NSF grant GP-19978 and presently supported under NSF grant PHY78-01684, heavy ion studies will begin using the new superconducting 500 MeV cyclotron presently being constructed under NSF grant PHY76-83256. As the 500 MeV cyclotron comes into operation, the program will change from predominantly in-house research to research involving many outside users and operation of the 50 MeV cyclotron will be phased out. The ongoing accelerator development program will shift from final design of the 500 MeV to studies towards a similar 800 MeV cyclotron proposed as the second stage of a powerful two-cyclotron heavy ion accelerator.

Among the areas of research to be pursued with the 50 MeV accelerator are: precision direct reaction measurements, exotic nuclei and mass measurments, nuclear excitation, beta and gamma spectroscopy, fundamental processes, nuclear astrophysics and heavy-ion studies. Some of the work using the 500 MeV machine will be extensions of work presently underway, including studies of exotic nuclei, high spin spectroscopy, giant multipole resonances and nuclear astrophysics. It is anticipated that entirely new studies will be carried out as new properties of nuclei are discovered. Possibilities exist as well in fusion reactions where a new range of heavy nuclei can be produced. Processes intermediate between complete fusion and peripheral quasi-elastic processes will also be studied. This area is replete with unexplained phenomena.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES

W.R. Snow, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (DF038680; AFOSR-74-2672)

AF function - weapons delivery, defense. Deficiency - advancement of predictive, detection, preventive and other techniques in rocket plume technology has been hampered by lack of fundamental reactive and radiative data. Specifically, determination of plume radar cross-sections requires input data on charged particle reactions. Objective -this four-year program is to provide measured data on ionization, recombination, attachment and detachment processes that occur with HCl and KCl and their elements. How work contributes - this work will provide data called for in research objective 5.1.2, and placed in the highest priority category by AFRPL.

Drift tube, flowing afterglow, modulated crossed beams and laser excitation techniques will be used for the various reactions to be studied. Quantitative effects of various collision partners and third bodies will be emphasized. Temperatures ranging from 300-10,000K and pressures from 0.1 to 10 sup 5 PA will be covered. Some of the important reactions being studied are ion-pair production from potassium and chlorine atoms, recombination of potassium ions as affected by third bodies, and the effect of clustering on the associative detachment of chloride ions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, HIGH-PRECISION NUCLEAR MAGNETIC SUSCEPTIBILITY MEASUREMENTS IN SOLID 3 HELIUM

P.B. Pipes, Dartmouth College, School of Arts & Sciences, Dept. of Physics, *P.O. Box 833, Hanover, New Hampshire* 03755 (DMR7704665A01)

This is a continuation of research initiated under DMR7704665.

High-precision nuclear magnetic resonance techniques combined with improved thermometry will be used to measure the RF magnetic susceptibility of solid helium-3 over the temperature range 0.4K to 0.02K. Experimental work will be performed at the National Bureau of Standards, Washington, DC, as part of a collaborative study. These data should resolve an existing thermodynamical conflict in existing data and will provide a clearer understanding of the fundamental aspects of nuclear exchange in quantum solids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, LIFETIMES AND QUENCHING RATES FOR THE TRIPLET PI STATES OF INTERHALOGEN MOLECULES

J. Wright, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Physics, *James Hall, Durham, New Hampshire* 03824 (DF047470; AFOSR-77-3232)

AF function - reconnaissance, communication, weaponry. Deficiency - there is a lack of a high-power, efficient, chemically pumped electronic transition laser which is a projected requirement for future Air Force applications. Objective - use laser-induced time-resolved spectroscopy to measure the decay rate and quenching rates for the triplet-pi states of several interhalogen molecules which are attractive candidates for chemical lasers. How work contributes - a requirement for a chemically-pumped electronic transition laser is that the decay rate of the excited state and quenching rates be less than the chemical reaction rate. This research intends to measure these rates for interhalogen molecules which have been identified as candidate electronic transition laser molecules.

A tunable dye laser will be used to excite the triplet pi electronic states of certain interhalogen molecules. Time resolved fluorescence spectroscopy will be used to infer the excited state lifetimes and quenching rates in the presence of other molecules.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, DIATOMIC MOLECULE PROPERTIES IN THE INTERMEDIATE ENERGY TO DISSOCIATION LIMIT RANGE

C.L. Beckel, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (DF046320; AFOSR-77-3132)

AF function - this research contributes to research objective 6.1, nuclear weapons effects. Deficiency - weapons effects computer codes need information on the energy levels of diatomic molecules. Objective - this program is directed toward achieving better understanding of and more useful procedures for treating diatomic molecule bound states in the intermediate to high energy range. Contribution - this research will permit more reliable description of diatomic molecule properties in high energy, high temperature environments.

Expressions are being developed that relate vibration-rotation eigenenergy E-Sub-V, J to vibrational quantum number V. Eigenvalues are being found for a set of model potentials and a corresponding set of actual potentials that correlate with a variety of separated atom states. Reduced mass is being varied to vary eigenvalue density as an aid in determining E-Sub-V, J versus V functional forms. Possible causes for failure of the RKR method near dissociation are being evaluated and improvements are being devised to make RKR useful at high-V.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, MATH INVESTIGATIONS

N. Tzoar, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DF902380; F19628-77-C-0114)

AF function - development of high data rate optical fiber communications. Deficiency - lack of knowledge regarding the detrimental effects of nonlinear pulse propagation in solid dielectric waveguides. Objective - determine possibility and conditions for propagation of intense short pulses for high data rate optical fiber communications. How research contributes - will determine

the characteristics and thus the feasibility of ultra-short pulse propagation in optical fibers.

Investigate the broadening and narrowing of short pulses in nonlinear circular optical waveguides by solving electromagnetic wave equations analytically and numerically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0024, MEASUREMENT OF THE MICROWAVE SURFACE IMPEDANCE IN NON-EQUILIBRIUM SUPERCONDUCTING THIN FILMS

J.C. Amato, Colgate University, Graduate School, Dept. of Physics & Astronomy, *Hamilton, New York* 13346 (DMR78-10279)

Superconducting systems can easily be driven far from equilibrium by externally-applied perturbations. In a non-equilibrium state, a superconductor or superconducting device may behave rather differently than it does in equilibrium. Recent theoretical advances make it possible to study the non-equilibrium state by measurement of transport properties. Such a study is proposed: measurement of the microwave surface impedance of superconducting thin films excited by moderately strong microwave radiation. A novel microwave cavity design greatly simplifies the measurement procedure.

There is an immediate technological and scientific need for experiments of this kind. An understanding of non-equilibrium superconductivity is essential for further development of millimeter and infrared superconductivity detectors. The distinctive features of this experiment offer a fresh, complementary study of the non-equilibrium state. In particular, use of single thin films, rather than tunnel-junction structures, will provide a clearer distinction between the role of the superconductor proper, and that of thermal coupling to the surrounding environment.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, GROWTH OF HOMOGENEITY CHARACTERIZATION OF MERCURY CADMIUM TELLURIDE CRYSTALS

F.H. Pollak, Yeshiva University, New York Campus, Graduate School, Dept. of Physics, *55 5th Ave., New York, New York* 10003 (DF039430; AFOSR-74-2714)

AF function - infrared detectors are essential solid-state components of air reconnaissance and surveillance systems. Opportunity - presently, infrared materials are insufficiently understood to produce detectors with predictable responses. The development of improved infrared detectors requires a full understanding of the roles defects, impurities and nonstoichiometry play in the detection process and their optimum performance in detector arrays. Objective - to characterize and understand the lattice response and detection properties of synthesized and specially-doped narrow band-gap compound semiconductors such as (Hg, Cd) Te systems having optimum detectivities in the spectral range of 8 to 14 micrometers. How work contributes - high density infrared detector arrays could result from this new approach to crystal growth, characterization and understanding of the electronic structure and optical properties of narrow band-gap semiconducting compounds.

Characterization of electronic structure and optical properties is accomplished non-destructively by a unique wave-length modulated photoresponse and by electrolyte electroreflectance (EER) spectroscopy to analyze impurity centers and to recognize actual changes in composition across the surface of a wafer with a spatial resolution commensurate with the dimensions of the detector array. A new approach to the growth of highly-uniform large (Hg, Cd)Te crystals involves the application of current-controlled liquid phase epitaxy (LPE) and evaluating topographical variations in stoichiometry of the grown crystals. The highly sensitive optical technique of the rotating light pipe reflectometer (RLPR) will be utilized to gain information about the formation and dissolution of anodic oxide films (potential Schottky barriers) which form on the surface of the crystal. Raman spectroscopy which is sensitive to surface conditions will be used to elucidate the structural nature of the chemical bonding at the surface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0026, EXPERIMENTAL HIGH ENERGY PHYSICS

D.K. Robinson, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (PHY7821338)

This research effort in experimental particle physics is searching for strong interaction resonances in K ion n interactions. They are measuring the angular distribution and the polarization of the recoil neutron in the reaction K ion n-K ion n. Analysis of the data should reveal whether there are particle resonances which do not fit in simple representations of SU(3).

This is a continuation of research initiated under NSF grant PHY77-21738 and is the first year of a two year grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0027, STRUCTURAL AND KINETIC PROPERTIES OF GRAPHITE INTERCALATED COMPOUNDS

D.L. Chung, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF051500; AFOSR-78-3536)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of less expensive lighter materials such as intercalated graphite compounds for electrical conductors. Intercalated graphite compounds, weighing about one fourth as those of copper, could have conductivities greater than those of copper. Objective - the objective of this research is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - this work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor of airborne systems.

The structural and kinetic properties of graphite intercalation compounds will be studied. Attention will be given to the microstructure which varies with the parent graphite material, the intercalate species and concentration, the sample preparation technique, the interaction of the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalated compound, the kinetics of intercalations, and the kinetics of exfoliation. Thermal gravimetric analysis, Auger spectroscopy, scanning and transmission electron microscopy, low and high energy electron diffraction and dilatometry will be used to investigate compounds based on various types of pristine graphite materials, such as pyrolytic graphite, graphite fibers, graphite whiskers, and grafoil.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0028, ION IMPLANTATION IN III-V COMPOUND SEMICONDUCTORS

G.W. *Eldridge*, Westinghouse Electric Corp., *3 Gateway Ctr., Pittsburgh, Pennsylvania 15222* (DF040310; F44620-75-C-0034)

AF function - microwave solid state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Opportunity - continuing systems requirements demand improvements in power, frequency, efficiency and noise properties in solid-state electronic devices. Currently, GaAs is being heavily investigated for its properties, but other III-V materials such as InP and GaIn AsP present the opportunity for higher performance devices due to some of their superior electrical characteristics. Objective - the objective of this research is to investigate the utility of ion implantation into InP and GaIn AsP for the selective control of doping profile control and junction formation. How work contributes - the control and understanding of ion implantation into these III-V materials will permit the fabrication of high performance microwave devices.

During the first portion of this research year, additional work will be carried out in order to optimize InP implant and encapsulation procedures. In order to determine the effect of substrate

quality on the implant results, low dose implants will be made into a variety of iron and chromium doped InP substrates as well as into some undoped VPE layers. Mobility data will then be correlated with these various implanted substrates. Any improvements in mobility or activation efficiency due to radiation damage gettering will also be investigated. Work will also continue on trying to improve the low activation associated with P-type implants. Finally, a systematic study of encapsulants will be made. Both carrier concentration and mobility will be profiled in unimplanted and annealed epitaxial layers. In addition, inert gas implants will be profiled to study radiation damage gettering and mobility recovery. In the second half of this research work will begin on GaIn AsP. First, epitaxial layers of this compound will be grown and characterized. Then work will begin on implants into this epitaxial material followed by encapsulation with silicon dioxide and silicon nitride layers. Inert gas and isoelectronic ions (as well as N-and P-type implants) will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0029, TOPICS IN THE PHYSICS OF FLUIDS - PHASE TRANSITIONS TO A STATE OF LOWER SYMMETRY

J.B. Swift, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7611426A01)

Research previously supported by DMR 76-11426. The research will be primarily concerned with the problem of dynamical phenomena near phase transitions to states displaying spatial structure. Several problems having to do with this topic will be investigated, including dynamics near the nematic-smectic-C transition of a liquid crystal and dynamics near the Lifshitz point of a liquid crystal. Also the dynamics near the paramagnetic helicoidal transition in isotropic models of magnetic systems, and acoustic attenuation near a critical point, will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, THEORY OF PLASMA WAVES IN THE EARTH'S BOW SHOCK

S.P. Gary, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185

Theoretical investigation of possible plasma instabilities in the earth's bow shock; solution of the complete electromagnetic, Vlasov, linear dispersion relation for conditions appropriate to perpendicular shocks, dominant instabilities, construction of appropriate nonlinear theories to determine saturation mechanisms and turbulent scattering frequencies. Structure of the earth's bow shock and how it heats the solar wind plasma. Dispersion relation for the case of unmagnetized ions and magnetized electrons undergoing an E-vector x B-vector drift. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0031, INFRARED SCHLIEREN SYSTEM

T.D. Wilkerson, Versar Inc., *6621 Electronic Dr., Springfield, Virginia 22151* (DF035040; F44620-72-C-0076)

AF function - aerospace vehicles. Opportunity - Schlieren optical systems have long been used to make visible the density inhomogeneities in experimental gas glows, especially in supersonic wind tunnels. This technique is limited in sensitivity by the small refractive effect of air on visible light wavelengths, making it useless for observation of a number of phenomena at low overall gas density. Anomalous dispersion near resonance absorption wavelengths results in refractive index enhancement by up to two orders of magnitude. This makes it attractive to develop Schlieren and interferometric methods for infrared wavelengths in the 5 to 10 micron region, where such resonance phenomena abound for many molecules of gas dynamic interest. Objective - to demonstrate the feasibility of infrared observations of gas dynamic phenomena that could not be observed by visible spectrum methods. How work contributes - this research is directed toward the problem of infrared image recording, special sensitivity problems associated with laser focal spot size combinations of observed gases and spectral wavelength for optimum sensitivity of optical methods of flow observation depending upon index of refraction variations in the gas.

Measurements will continue on infrared refractive index and absorption surveys near available laser lines on a selection of molecular species, and flow visualization experiments, using suitable combinations of gas and infrared wavelength, will demonstrate these methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0032, ELECTRICAL CONDUCTIVITY OF SHOCK-COMPRESSED INSULATORS

G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF051190; AFOSR-78-3478)

AF function - Air Force studies of the effects of nuclear blasts are consistently plagued by problems of unwanted electrical conductivity in monitoring probes. Opportunity - mechanisms of conduction are not understood, and no rational basis for selecting better insulation is available. Objective - this research will define the role of ionic conduction in shock induced conductivity in crystalline solids, investigate the role of electron excitation in shock induced conductivity in organic materials, and design a set of experiments for measuring shock induced conductivity up to pressures of about 1 megabar. How work contributes - the results and understanding obtained through this research will lead to a set of recommendations for selection and development of insulating materials for use under shock loading conditions.

A survey will be made of information on the electrical conductivity of insulators under shock conditions. An experimental arrangement will be designed for measuring electrical conductivity in both the Washington State University and AFWL contractor's (Sandia Labs) gas gun facilities. A series of shots will be made to determine the characteristic features of ionic conduction in a shock wave, and the relationship of basic mechanisms to the development of insulators for use at very high shock pressures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0033, SURFACE WAVE INVESTIGATION OF SUPERCONDUCTING ALLOYS

M. Levy, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF041820; AFOSR-76-2893)

AF function - superconducting materials are needed for application in airborne multi-megawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - this research involves a unique technique, ultrasonic surface waves, to investigate flux pinning, flux flow and AC losses in films of superconducting alloys including A-15 compounds and solution hardened titanium alloys. The effect of nickel films on surface acoustic wave devices will be studied. How work contributes - the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators and inductive energy storage systems could be significantly improved if AC power distribution losses, transients and mechanical breakdown of the superconductor were reduced.

Surface waves will be used to make measurements on thin superconducting films and on nickel films. These measurements will be performed in the 0.6 to 3.5 gigahertz frequency range. The *Nb3Ge films will have to be deposited on sapphire substrates* overlayed with a piezoelectrically active aluminum nitride film in order to produce the surface waves. A technique for exciting surface waves with sputtered *ZnO films will* be developed. Time of flight and ultrasonic attenuation measurements of both the ternary compound ErRh4B4, superconducting alloys and solution hardened titanium alloys. These measurements will be done as a function of temperature, and for the superconductors, they will be also done as a function of magnetic field. Thermal expansion

measurements will be performed in order to determine the elastic constants of these samples. A magnetometer will be used to determine the Ginzburg-Landau parameters K1 and K2 for the type II superconductors. Electron phonon interaction will be measured in the mixed state of bulk superconducting alloys in order to study flux motion in these superconducting alloys. The ultrasonic attenuation coefficient will be measured as a function of applied external magnetic field. The temperature of the isolated samples will be measured simultaneously in order to also determine thermal heating in these alloys as flux penetrates or escapes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ASTRONOMY RESEARCH AT THE OWENS VALLEY RADIO OBSERVATORY

A.T. Moffet, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (AST7700247A02)

Extragalactic research will center on the fine scale radio properties of quasars and the nuclei of active galaxies, the continued study of the polarization and intensity changes in variables sources, and the kinematics and gas content of nearby galaxies. Galactic research will include studies of isotope abundances in various parts of our galaxy, the fine structure of the non-thermal source of radiation at the galactic center and the physical properties of dense clouds of dust and gas which are regions of star formation and large scale natural masers.

The solar system work will continue on the scattering properties of the rings of Saturn, the shape of the Jovian radiation belts and the thermal properties of the major satellites.

A second precise 10-meter diameter antenna will be brought into service as part of a three element millimeter wave interferometer. Low noise receivers and an advanced autocorrelation spectrometer will be brought into use on these telescopes. Interferometric observations will be started.

This research is a continuation of work previously supported under NSF Grant AST 77-00247.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, ANALYSIS OF MOLECULAR SPECTRA

J.G. Phillips, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST7605905 A02)

The successful study of molecular structure, excitations and abundances in astrophysical sources requires extensive and reliable laboratory information on molecules. This information includes transition identifications, relative and absolute transition probabilities and dissociation energies. This research program will provide astrophysicists with such information. During the coming year, the analysis of ZrO will be completed. The infrared spectrum of TiO and the spectra of FeH and FeD will be studied. A program to measure the lifetimes of excited molecular states will be carried out. Computer generated synthetic spectra of ZrO will be compared with electronic furnace spectrograms and photoelectric scans. The laboratory measure, analyses and transition probabilities will be applied to studies of molecular spectra found in cool stars.

This action provides additional funding for work previously supported by NSF grant AST76-05905A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, COMPARATIVE STUDY OF IGNIMBRITES, IMPACTITES AND CHONDRITES

K. Fredriksson, Smithsonian Institution, Div of Meteorites, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560 (3350-49)

Detailed petrographic, mineralogical and geochemical studies will be made on series of ash flow rocks, impactites (Gosse's Bluff, Australia and Chassenon, France) and certain chondrites. These rocks are frequently similar in gross fabric although chemically very different. The study aims towards an understanding of the 'welding' process in ash flow tuffs and impactites (both of which may be present on the lunar surface) as well as an explanation of the wide textural variations within chemically well-defined groups of chondrites.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

10.0004, A STUDY OF THERMONUCLEAR PROCESSES ON ACCRETING NEUTRON STARS .

P.C. Joss, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-21993)

The X-ray burst sources are a recently discovered class of objects which are characterized by repetitive short, intense outbursts of X-ray radiation. Over thirty such sources are now known and they appear to be concentrated in the direction of the galactic center. It has been suggested that the X-ray bursts are caused by matter falling onto a massive black hole. Another suggestion for these sources involves runaway thermonuclear reactions taking place on the surface of neutron stars.

Detailed numerical models of thermonuclear burning in the surface layers of accreting neutron stars will be computed. These computations will test the hypothesis that it is thermonuclear flashes on neutron stars that are the source of the X-rays. These studies will also be relevant to the question of the stability of nuclear burning in the surface layers of X-ray pulsars.

Another type of X-ray source that has been detected are the transient X-ray sources, or 'X-ray novae.' They have luminosity variation timescales ranging from days to months. The X-ray emission of some of these sources may result from thermonuclear flashes in the envelopes of neutron stars having a mass of about one-tenth of a solar mass. Models of such sources will be constructed.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, STELLAR PHYSICS - ANALYSIS OF SOLAR ROCKET AND SATELLITE DATA

E.H. Avrett, Smithsonian Institution, Astrophysical Observatory, Solar & Stellar Physics Division, *60 Garden St., Cambridge, Massachusetts* 02138

Development of numerical methods for the solution of the equations of statistical equilibrium and the equation of radiative transfer in spectral lines and in continua. Application of the numerical methods to solar and stellar lines of multilevel atoms, especially in study of the chromospheric structure of the sun. Investigation of the properties of radiation emerging from stochastic media, and media exhibiting horizontal structure. Study of deviations from local thermodynamic equilibrium in stellar photospheres. Determination of the source function from observations of solar lines by means of an inversion of the Laplace transform. Development of methods for correcting observed spectral profiles for instrumental broadening and noise.

Also, studies of observational data, namely ultraviolet spectra of the sun, to be used to test and improve SAO models of the variation with optical depth of structure, density, and pressure in quiet regions of the sun. The improved models will then be used to extend this analysis to active regions.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0006, 24-INCH TELESCOPE

D.W. Latham, Smithsonian Institution, Astrophysical Observatory, Optical and Infrared Division, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-14)

This is a joint project with the State University of New York at Stony Brook to install and operate an Ealing-Beck 24-inch optical telescope at Mt. Hopkins. This telescope will complement the existing 60-inch telescope, since it will be installed nearby and will accommodate the same set of auxiliary instruments.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0007, AN ASTRONOMICAL OBSERVING PROGRAM IN ISRAEL

M. Lecar, Smithsonian Institution, Astrophysical Observatory, 60 *Garden St., Cambridge, Massachusetts* 02138 (SFG 0 3005)

An observatory has been constructed and instrumented and is now operating in the Negev desert in Israel. The observatory is jointly financed by Tel Aviv University and the Smithsonian Institution; 50% of the observing time is reserved for US observers. The observations were made at the Israeli site (in connection with the moon, and with X-ray observations of SCO-XR-1). The major instruments at this new observatory are: a 40 inch wide-field telescope manufactured by Boller & Chivens, a photometer made at Cal Tech, and an image tube spectrograph made by Boller & Chivens. Currently under design is a Videcon System to be made by Bell Labs, Princeton University Observatory and the Beta Company in Israel. The observatory was dedicated in October 1971, and a number of cooperative observing programs are underway.

Plans have been drawn for the last major instrument - a digital (TV) camera and the process of negotiating its fabrication at the University of Texas has begun. The estimated completion data is June 1975. During the past year, there were some interruptions in the observing schedule, but the astronomers did produce an additional dozen research contributions including an unambigious determination of water in Comet Kohoutek.

SUPPORTED BY Smithsonian Institution, Museum of History & Technology

10.0008, COSMIC RAY ACCELERATION AT THE SUN

D.J. Mullan, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (ATM7820936)

The emission of energetic particles from the sun disturbs the space environment around the Earth. To understand and predict these disturbances, it is important to investigate the conditions in the sun which allow particle acceleration to high energies. In association with some solar flares, cosmic rays are accelerated over a wide energy range. The relativistic component of cosmic rays persists for only a short time. At lower energies, a long-lasting component persists for many hours or even days. Detailed knowledge as to how and where these two components are accelerated is currently unavailable. The aim of the research supported here is to investigate theoretically processes whereby particles may be accelerated, with a view to determining how and where the particles gain energy. To do this, the effectiveness of two general classes of acceleration mechanisms in the sun's atmosphere will be evaluated quantitatively at a time when a region of the atmosphere has been modified by a flare explosion. The plan is to calculate how the solar atmosphere is modified by a blast wave from a flare, and then examine acceleration mechanisms associated with the blast wave itself as well as with the hot gas left behind the blast.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0009, THE SPECTROSCOPY AND THEORY OF HERBIG-HARO OBJECTS AND OF ATMOSPHERES OF WHITE DWARF STARS

K. Bohm, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST7820542)

The research to be carried out under this grant will involve studies of objects that are believed to represent early stages in stellar evolution (Herbig-Haro objects) and studies of objects that represent very late evolutionary stages -- white dwarf stars.

Herbig-Haro objects are found to occur only in regions where star formation and early stellar evolution are taking place. These objects are found in dark nebulae, and have a stellar or semistellar nucleus surrounded by a small emission nebulae. Observations of these objects has shown that they are changing over a time period of a few years, and there has been considerable speculation that these objects may be newly forming stars. Thus, it is necessary to determine the physical conditions in such objects and their energy sources. The research to be carried out will involve a detailed comparison of spectra photometric data for the very brightest of these objects with detailed theoretical predictions in order to determine some of the physical parameters of these objects. There will be studies of the heavy element abundances in the objects.

The atmospheres of cool white dwarf stars will be studied. These studies are important for an understanding of the final cooling stages of a star. The photospheres and coronae of hot white dwarf stars will be examined in order to improve our understanding of the observed extreme ultraviolet and soft X-ray radiation from these objects.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0010, HIGH ENERGY ASTROPHYSICS

P.B. Boynton, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST7722326A01)

In recent years a number of binary stellar systems which emit X-rays have been detected. One of the most unusual of these systems is the system known as HZ Hercules (Hercules X-1). This system shows a number of clearly defined periodic phenomena at optical and X-ray wavelengths. The system consists of a relatively low luminosity star and a compact companion star. This companion is surrounded by a disk of material which is produced from matter ejected by the low luminosity star.

The research to be carried out under this grant will involve analysis of data in order to obtain information on the mass transfer mechanisms taking place in the system. There will be studies of the manner in which material lost from the luminous star interacts with the disk of material surrounding the compact object. The properties of this disk material will be analyzed. Some of the periodic behavior observed in the X-ray emission from this star will be examined.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-11999* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 114
Oct. 1979 116 p
(NASA-SP-7037(114)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 394 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1979. Author

N80-12000# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AEROELASTIC PROBLEMS IN AIRCRAFT DESIGN
1979 534 p Lecture held at Rhode-Saint-Genese, Belgium, 7-11 May 1979
(VKI-Lec-Ser-1979-8) Avail: NTIS HC A23/MF A01

A review of present knowledge in aeroelasticity and the methods used to solve aeroelastic problems are discussed. A modal analysis of aircraft structures and a determination of structural inputs for aeroelastic analyses are presented. Aircraft flutter and dynamic response, wind tunnel flutter techniques, and flight flutter techniques are examined. For individual titles, see N80-12001 through N80-12012.

N80-12001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
A SURVEY OF AEROELASTIC PROBLEMS c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 p 1-15 refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

A survey and a classification of aeroelastic problems are presented. The interaction of the aeroelastic system forces is demonstrated by means of functional diagrams, and the application of operators for the general formulation of aeroelastic problems is shown. Author

N80-12002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
AEROELASTICITY FROM THE VIEWPOINT OF THE DESIGNER c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 32 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The effects of aeroelastic phenomena on aircraft design and development are discussed and illuminated through representative practical examples. A survey of structural dynamic loading problems arising with the development of launch vehicles is presented. A.W.H.

N80-12003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
MODAL ANALYSIS OF AIRCRAFT STRUCTURES c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 26 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The physical and analytical relations of the modal approach, in terms of natural modes and generalized coordinates, for the analytical treatment of dynamic aeroelastic problems of aircraft are demonstrated. Two modal techniques are derived based on the generalized equations of motion of the elastic structure. These are a modal substructure coupling technique, and a modal perturbation method. A.W.H.

N80-12004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
LIFTING SURFACE DIVERGENCE AND CONTROL EFFECTIVENESS c05
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 35 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The various methods of analyzing static aeroelastic phenomena on high aspect ratio swept and unswept wings are presented. The problems of static aeroelastic divergence, aileron effectiveness, and symmetric and antisymmetric lift distribution are discussed. Examples of the various computation procedures are presented. A.W.H.

N80-12005# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
MODAL REPRESENTATION AND TRANSFER FUNCTION OF LINEAR DISSIPATIVE STRUCTURES c05
Roland Dat *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 20 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The methods used for modeling structures with their normal modes or their natural damped modes are presented. The principle of the classical modal representation is reviewed and the analytic formulation of the transfer functions is obtained as a superposition of natural damped modes. Vibration testing methods based on this formulation is presented. The determination of the structural dynamic characteristics with only one excitation point or only one point of measurement using the vibration testing methods is discussed. A.W.H.

N80-12006# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
NEW METHODS FOR GROUND TESTS OF AERONAUTICAL STRUCTURES c05
G. Piazzoli *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 22 p refs In FRENCH; ENGLISH summary (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The dynamical identification of structures by classical method, based on the distribution of synchronous multiexcitations appropriate for each modal resonance, is discussed. The

inaccuracies of the method when it is applied to complex systems, such as aeronautical structures, are described. Two methods are described. The first method consists in resolving the eigenvalues equations of a complex power matrix. The second method is based on the research of a set of forces which isolate one mode and cancel all others. The data acquisition and processing techniques of the ground tests are described. A.W.H.

N80-12007# Avions Marcel Dassault, Saint-Cloud (France).
PRACTICAL ASPECTS OF THE CALCULATION OF STRUCTURAL VIBRATIONS c08
J. P. Brevan *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 60 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The computation of the vibration modes of structures with finite element models, which leads to large sparse generalized eigen problems, is presented. The basic tools such as sparse matrix factorization are described. A review of the methods for eigensolutions is given. Two methods currently in use, the Lanczos method and the subspace iteration method, are examined. A dynamic substructuring method is presented. Practical results for the model of a complete aircraft are given. A.W.H.

N80-12008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
UNSTEADY AERODYNAMIC INPUTS FOR AEROELASTIC ANALYSES: A GENERAL INTRODUCTION c02
W. Geissler *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 102 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The arbitrary time dependent equations of motion in fluid dynamics which serve as the starting points for aeroelastic investigations are examined. Solution procedures based on integral or singularity methods are described for pure sub- and supersonic flows and the corresponding boundary conditions are determined. The prediction methods used in unsteady aerodynamics are discussed. A.W.H.

N80-12009# National Aerospace Lab., Amsterdam (Netherlands).
REMARKS ON THE TRANSONIC FLOW PAST OSCILLATING AIRFOILS c02
H. Tijdeman *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 33 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The characteristics of unsteady and steady transonic flow are reported. The transonic flow past an oscillating airfoil is discussed. Three types of shock waves which are identified in the flow field of an airfoil are examined. The linear relation between the frequency of oscillation and the motion of the shock wave is discussed. A qualitative analysis of the contribution of an oscillating shock wave to the overall loading is presented. A.W.H.

N80-12010# Liege Univ. (Belgium).
AIRCRAFT FLUTTER AND DYNAMIC RESPONSE c08
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 58 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The equations of motion and the dynamics of the elastic airplane are presented. The fundamentals of unsteady aerodynamics and an analysis of flutter and dynamic response are discussed. A.W.H.

N80-12011# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
WIND TUNNEL FLUTTER INVESTIGATIONS c08
O. Sensburg *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 59 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

Wind tunnel investigations with rigid and dynamically scaled models are examined. An assessment of the influence of parameter variations on flutter speed such as geometry changes, stiffness changes, and external store mass properties is presented. The measurement of unsteady aerodynamic forces with direct pressure transducers or tubes is discussed. Buffet investigations on rigid models are reported. A.W.H.

N80-12012# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
FLIGHT FLUTTER TESTING c08
G. Haidl and M. Steininger *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 41 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

The excitation methods applied to flight flutter testing are described. Examples of excitation by frequency sweep, pseudo random, harmonic oscillation and control feedback technique are given and their effectiveness and adaption to digital processing is discussed. Experience with generating aerodynamic forces by control surfaces or additional vanes is presented. The digital analysis of flight flutter test data is evaluated. Recommendations for selection of analysis parameters and how to avoid errors due to digital processing are given. Errors and effects of digital blockwise computation and analysis procedures like block overlapping, windowing, averaging or curve fitting are demonstrated. A.W.H.

N80-12013# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-4
Paris ESA Jun. 1979 167 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4, Jul.-Aug. 1978 p 143-212
(ESA-TT-561) Avail: NTIS HC A08/MF A01

The collection of papers includes the calculation of flows around wings, the three dimensional supersonic flow in an axial compressor by a method of characteristics, the calculation-experiment comparisons of the transonic two-dimensional flow in a high deflection cascade, the application of sputtering to the improvement of coatings of superalloys, a new method of electric measurement of crack length, preliminary tests in a cryogenic wind tunnel driven by induction, and a theoretical analysis of radiation pressure on a uniform sphere as a function of skin optical properties. For individual titles, see N80-12014 through N80-12020.

N80-12014# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF TRANSONIC FLOWS AROUND WINGS c02
Jean-Jacques Chattot, Colette Coulombeix, and Carlos daSilvaTome *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 1-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 143-159 Original language report was announced as A79-11132 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The full potential equation is chosen as a mathematical model for simulating transonic flows of an ideal fluid past symmetrical wings set without side-slip in a uniform subsonic free stream. Two relaxation methods are presented. In the first method the equation is written in quasi-linear form and is discretized using a mixed scheme of the Murman-Cole type. The algebraic set of difference equations is solved by column relaxation. In the second method the equation, together with an artificial viscosity term, is written in conservation form and is discretized using a centered scheme. An approximate factorization method is used to solve the difference equations. Results obtained with the two methods are presented for a rectangular wing, the M6 wing and the AFV-D wing, and include comparisons with experimental data.
Author (ESA)

N80-12015# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF THE THREE-DIMENSIONAL SUPERSONIC FLOW IN AN AXIAL COMPRESSOR BY A METHOD OF CHARACTERISTICS c02
Jean Martinon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 42-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4,

Jul.-Aug. 1978 p 161-174 Original language report was announced as A79-11133 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

A three-dimensional method of characteristics was developed to describe the axial, radial, and tangential variation of the velocity field in the supersonic domain of axial compressors. The calculation was adapted to calculate the flow in a straight cascade with converging walls, and the flow in a supersonic, annular cascade. The ideal-fluid calculation provides a very useful first approximation of the flow in the inviscid region and gives basic information for the determination of viscous effects. The case of fixed or rotating cascades is treated by means of a bi-characteristic mesh, using a method for eliminating terms involving derivatives which do not act in the grid directions. This method leads to higher precision. The results show that the computer program developed for the two cases examined, requires a shorter computer time than any other known method. Author (ESA)

N80-12016# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION - EXPERIMENT COMPARISONS OF THE TRANSONIC TWO-DIMENSIONAL FLOW IN A HIGH-DEFLECTION CASCADE c02
Georges Meauze *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1978-4 Jun. 1979 p 79-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 175-180 Presented at Euromech. Colloq. 87 on Transonic Flows in Turbomachines, Prague, 12-15 Apr. 1977 Original language report was announced as A79-11134 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The validation of transonic flow calculations in compressor cascades is discussed. The method under study is the pseudo-unsteady method (using the assumption of a flow with constant stagnation enthalpy and entropy) and is first compared to a classical calculation performed by a relaxation method (Katsanis method), with good agreement. Experimental results, as comprehensive as possible, are then compared with the calculations. The comparison is very satisfactory if the viscous layers developing along the blade surfaces are taken into account, provided that their effects do not become predominant.
Author (ESA)

N80-12017# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF SPUTTERING TO THE IMPROVEMENT OF COATINGS OF SUPERALLOYS c26
Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 94-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 181-194 Original language report was announced as A79-11135 Sponsored by DGRST (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The utilization of protective alloy precoatings on superalloys used for aeronautical turbines by sputtering techniques in order to further improve their corrosion resistance is discussed. The equipment used for cathodic sputtering and the conditions of deposition are specified. Deposits of pure Ni and Ni based alloys of simple composition were produced, then transformed into aluminides. Deposits of Co Based alloys, which are directly protective, were also obtained. It is concluded that industrial production of predeposits, before aluminization of alloy coatings, does not show particular technical difficulties for simple shaped bodies such as blades. Its limitations for producing deposits on the internal surface of cooled blades are pointed out.
Author (ESA)

N80-12018# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ELECTRIC MEASUREMENT OF CRACK LENGTH c33
Georges Baudin and Humbert Policella *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 125-144 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 195-203 Original language report was announced as A79-11136 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

Improvements to devices which are used to determine the existence of progression of a crack in an electrically conducting material are discussed. A pulsed electrical supply is used which reduces the response time of the measurement and, in particular, makes it free from noise and from zero drift in the d.c. amplifier. In the case of cyclic loadings, the pulses can be synchronized with the loadings. After describing in detail an instrument of this type, the flexibility of use and the performances obtained are shown for specific applications, such as the measurement in direct current of the length of a crack in two dimensions.
Author (ESA)

N80-12019# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRELIMINARY TESTS IN A CRYOGENIC WIND TUNNEL DRIVEN BY INDUCTION c09
Roger Michel and Dietrich Faulmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 145-152 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 205-207 Presented at Supersonic Tunnel Assoc. Meeting, El Segundo, Calif., 17-18 Apr. 1978 Original language report was announced as A79-15300 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

A 1/4 scale cryogenic operation pilot wind tunnel test for higher Reynolds number was performed to verify a liquid nitrogen injection fast cooling process. The cryogenic operation was combined with an induction driven operation in the hope that the short flow duration will give rise to a decrease in the wall and model surface temperature only, avoiding some technological problems. Operation temperatures down to 100 K were obtained. Thin layers of wall insulation are shown to be efficient in containing nitrogen consumption. It is concluded that the simplicity of implementation makes the process promising for adapting existing wind tunnels to cryogenic operation. Author (ESA)

N80-12020# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIATION PRESSURE ON A UNIFORM SPHERE AS A FUNCTION OF SKIN OPTICAL PROPERTIES c44
Andre Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 153-163 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 209-212 Original language report was announced as A79-11137 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

The radiation pressure produced by a sun type spectral distribution or by a 220 K black body is theoretically studied for the case of a uniform sphere. A general expression is initially reached, considering that for perfectly absorbant, perfectly reflecting, perfectly scattering, and mixed cases the coefficients are independent of the angle of incidence. It is deduced that for a perfectly scattering sphere the reflection factor does not have any effect on the system response, and that the chromatic error is zero for any nonscattering sphere. Considering then the case of a real skin, in which the scattering factor diminishes with frequency, and the reflection factor increases with the angle of incidence, it is concluded that an optically polished surface would eliminate the effects of chromatic error. Author (ESA)

N80-12021# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN NO. 1978-5
Paris ESA Jul. 1979 102 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-286
(ESA-TT-555) Avail: NTIS HC A06/MF A01

Topics included are: flow separation along a line of a regular surface, missile trajectories by Kalman filtering-smoothing, the flow within a turbomachine combustor, aeroacoustic characterization of free jets, calculation methods associated with cyclic and damage constitutive laws, large scale structures in turbulent jet mixing layers, and thermoelastic properties of media with

periodic structures. For individual titles, see N80-12022 through N80-12028.

N80-12022# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SEPARATION OF A FLOW ALONG A LINE OF A SMOOTH SURFACE c02
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 1-12 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-219 Original language report was announced as A79-18531 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A method, much more elementary than those used up to now, is proposed for the study of the separation of a flow along a line of a regular surface. The definitions of the main part of the boundary layer and of the laminar sublayer are gradually generalized for complex flows. The behavior of the separation angle, the external flow, and the two parts of the boundary layer are then described with a minimum of calculation. However, the study of the strong coupling between a supersonic external flow and a boundary layer is only sketched. Author (ESA)

N80-12023# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESTITUTION OF MISSILE TRAJECTORIES BY KALMAN FILTERING-SMOOTHING c15
Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 13-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 221-232 Original language report was announced as A79-18532 Sponsored by DRET (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A method for determining the whole trajectory of a missile is described. Only measurements provided by the launching range tracking means (radars, etc.) are used. It is based on an algorithm of filtering and smoothing which is based upon the Kalman filtering technique: the model of the process dynamics takes into account the unknown characteristics of the missile and the model of the measurement measurements, then is applied to the estimation of a missile trajectory, using real data.
Author (ESA)

N80-12024# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS AND MODELLING OF THE FLOW WITHIN A TURBOMACHINE COMBUSTOR c07
Patrick Hebrard, Philippe Magre, and Gerard Collin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 33-54 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 233-249 Original language report was announced as A79-18533 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

The control of the correct operation of a turbomachine combustor requires the knowledge of the organization of the flow within the primary zone, where most combustion reactions take place. A study has been carried out with hydrodynamic and aerodynamic models, without and with combustion. The direction and intensity of local flow velocities have been determined, and were used as a basis for a simplified combustor model allowing a reasonably good prediction of the combustor overall performance. These results will also be used as a support for the development of methods for calculating threedimensional, turbulent flows with chemical reactions; these methods should provide a more refined description of combustor characteristics.
Author (ESA)

N80-12025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROACOUSTIC CHARACTERIZATION OF FREE JETS c71
Georges Elias, Annie Lelarge, Jean Maulard, and Mariano Perulli *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 55-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 251-261 Original language report was announced as A79-18534 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

The methods used to characterize sources of aircraft engine noise are described. These include (1) IR radiometry, which is sensitive to temperature fluctuations, (2) laser Schlieren method, giving data proportional to components of the density gradient, (3) Doppler laser anemometry, and (4) fluorescence diffusion measurements to deduce mean and fluctuating concentration. Complex measurements by more than one technique and employing crossed paths were experimented with, in order to reveal the complementary possibilities of the methods. By means of a principle of scale separation and suitable data evaluation methods, reliable statements about noise sources could be obtained. Author (ESA)

N80-12026# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION METHODS ASSOCIATED WITH THE LAWS OF CYCLIC AND DAMAGE BEHAVIOR c39
Serge Savalle and Jean-Pierre Culie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 71-92 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 263-278 Original language report was announced as A79-18535 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

Models of cyclic viscoplastic flow and damage laws are reviewed and incremental methods of linearization are summarized. These include Euler's method, the Euler-Cauchy method, the Runge-Kutta method, and a second-order method. Berger's method of automatic step-size determination is recalled. The methods were applied to a simple example of a one dimensional problem of isothermal relaxation strain hardening at constant strain and are compared with respect to the tradeoff between precision and number of calculations. The methods were also applied to integration of damage laws with and without creep/fatigue interaction. The effect of damage on the cyclic viscoplastic flow was investigated numerically. Author (ESA)

N80-12027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL INVESTIGATION OF LARGE SCALE STRUCTURES IN TURBULENT JET MIXING LAYERS c02
Otto Leuchter and Khoa Dang *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 93-96 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 279-282 Presented at Working Group on Coherent Struct. and Turbulent Boundary Layers, Bethlehem, Penn. 1-3 May 1978 Original language report was announced as A79-18536 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A simple method of conditional sampling for identifying coherent structures in jet mixing layers is used to characterize the effects of initial conditions, such as turbulence, and initial boundary layers. Ensemble averaging is initiated from the peaks occurring either in the hot-wire signal or in separated signals from a trigger probe. Author (ESA)

N80-12028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION OF STATIC THERMOELASTIC PROPERTIES OF MEDIA WITH PERIODIC STRUCTURES c39
Daniel Engrand *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 97-102 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 283-286 Original language report was announced as A79-18537 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

A law describing in a global manner, the thermoelastic behavior of heterogeneous materials whose mechanical properties are periodic functions of the space variables, is discussed. A novel application of homogenization theory furnishes a solution to this problem. Two examples are presented, one for a compound bar and another for a composite material. Author (ESA)

N80-12029# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1978-6
Paris ESA Sep. 1979 109 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 1-107
(ESA-TT-560) Avail: NTIS HC A06/MF A01

Research is presented on aerodynamic research on helicopters, shock wave-boundary layer separation interaction, the Pogo effect, flight results of the cactus accelerometer, spectrometer for the first Spacelab mission, and potential of velocities generated by a localized vortex distribution. For individual titles, see N80-12030 through N80-12034.

N80-12030# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONERA AERODYNAMIC RESEARCH WORK ON HELICOPTERS c02
Jean-Jacques Philippe and Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 1-23 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 287-304 Presented at AGARD Symp. on "Rotocraft Design", Moffett Field, Calif., 16-19 May 1977 Original language report was announced as N78-19148 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

Aerodynamic research on helicopters included basic research in two or three dimensional flows and studies on rotors. The study of steady and unsteady characteristics of airfoils and of problems pertaining to blade tips and to vortex interactions is discussed. For the rotors, a computing program for the forces on the blades, based on the acceleration potential method was developed. The problems of unsteady transonic aerodynamics related to high speed flight are also discussed. In order to perform wind tunnel tests for helicopter companies and for research purposes two rotor test rigs were developed. Results of the total forces on helicopter, for absolute pressure on the blades, for identification of the boundary layers, for smoke visualization, and for rotating blade deformations are presented. Author (ESA)

N80-12031# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS OF THE SEPARATION DUE TO SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTION IN TRANSONIC FLOW c02
Jean Delery *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 23-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 305-320 Original language report was announced as A79-25074 Sponsored by DRET (Res. Directorate, Min. of Defence) (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

Holographic interferometry and laser velocimetry were used in conjunction to analyze the flow resulting from the interaction between a shock and the boundary layer in a two-dimensional transonic duct. The Mach number at the beginning of the interaction is 1.37 and the local Reynolds number based on initial boundary layer thickness is 85,000. Initially, the external flow was investigated in order to obtain an accurate map of the nondissipative field and a description of the structure of the system of lambda shocks associated with the interaction. The laser velocimetry data allowed a characterization of the organization of the dissipative layer, which included a large separated zone. The following parameters were measured on the basis of a sample of 5000 values of the instantaneous velocity U: mean velocity, fluctuation factor, and the coefficients of skewness and flatness. Author (ESA)

N80-12032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A SYNTHESIS OF THE EXPERIENCE ACQUIRED BY ONERA ON THE POGO PHENOMENON c15
Daniel Lourme, Jean-Jacques Dordain, and Denis Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 45-67 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 321-334 Original language report was announced as A77-51427 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The structure-propulsion instability (termed the pogo effect) encountered in rocket launching is discussed, and a simplified mathematical model for studying such instability is given. A feedback loop defining the interactions of the combustor, the fueling apparatus and the structure of the launch vehicle is considered; linearized equations describing the dynamic behavior of the system are presented. Stability criteria, such as that related to the concept of critical damping, are reviewed, and the difficulties of obtaining fully coupled solutions to the analysis are cited. In particular, the problem of defining a margin of safety when the natural frequency of the structural system approaches the natural frequency of the propulsive system is addressed. An approximate solution, capable of assessing the need for a stabilizer in a launch vehicle under development, is given. This method is applied to the analysis of the L140 stage of the launch vehicle Ariane. Author (ESA)

N80-12033# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYNTHESIS OF FLIGHT RESULTS OF THE CACTUS ACCELEROMETER FOR ACCELERATIONS BELOW ONE BILLIONTH G c19
Yves Boudon (Centre of Geodyn. and Astron. Res., Grasse, France), Francois Barlier, Alain Bernard, Remy Juillerat, Anne-Marie Mainguy, and Jean-Jacques Walch (Centre of Geodyn. and Astrodyn. Res., Grasse, France) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 67-76 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 355-364 Presented at 29th Intern. Astronautical Congr., Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11247 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The Cactus accelerometer aboard the Castor satellite has been functioning continously and nominally for forty months. The paper reports on measurements of very weak accelerations, due mostly to infrared radiation pressure from the earth when the satellite is in the earth's shadow, or due to the thrust the satellite experiences under the influence of the anisotropy of its own radiation. Some of the measured accelerations are of the order of one billionth G. Author (ESA)

N80-12034# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD c19
Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-353 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

The grille spectrometer for measuring stratospheric and mesospheric composition, which will be mounted on board permits infrared measurements of active atmospheric constituents in the altitude range where their local concentration is higher than 100 million mol/cu cm. The instrument operates in two modes: in absorption with the sun as a source and in emission in the spectral ranges corresponding to the thermal emission of atmospheric gases. The instrument consists of a sighting system (tiltable front mirror), a radiation collector, a monochromator with output optics and detectors, and electronic subassemblies for the instrument command and its connection with the Spacelab electronic system. Author (ESA)

N80-12035# European Space Agency, Paris (France).
CONTRIBUTIONS TO GAS DYNAMICS AND AERODYNAMICS
F. Maurer Jun. 1979 328 p refs Transl. into ENGLISH from "Beitrage zur Gasdynamik und Aerodynamik", DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Original German report available from DFVLR, Cologne DM 64.30
(ESA-TT-518; DLR-FB-77-36) Avail: NTIS HC A15/MF A01

A collection of 15 original contributions from different fields of experimental and theoretical gasdynamics and aerodynamics is presented. Experimental contributions investigate problems of missile aerodynamics in transonic and supersonic flow and two experimental contributions deal with hypersonic boundary layer development in longitudinal corner flows and shock-shock and shock-boundary interaction in rarefied hypersonic flow. The problems of laser-Raman spectroscopy are also investigated. Results of atmospheric density, temperature, and pressure distribution measurements within the meso and thermosphere are derived from sounding rocket pitot pressure experiments. The remaining contributions are theoretical studies of three-dimensional, compressible flow fields and boundary layers using numerical methods. For individual titles, see N80-12036 through N80-12050.

N80-12036# European Space Agency, Paris (France).
ON THE SIMULATION OF AN UNDEREXPANDED PROPULSIVE JET FOR THE WIND TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY OF FLIGHT VEHICLES IN SUPERSONIC FLOW c02
Hans Emunds and Hansgeorg Riedel *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 15-44 refs Transl. into ENGLISH from "Zur Simulation eines unterexpandierten Treibstrahls beider Untersuchung der statischen Laengsstabilitaet von Flugkoerpern im Windkanal bei Ueberschallanstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Three different kinds of simulation of an underexpanded propulsive jet comprising cold air were investigated in a 30 x 30 sq cm supersonic wind tunnel to determine the effect of the jet of the static longitudinal stability of some typical flight vehicle configurations. A jet simulation by solid body, by an annular gas jet with cylindrical solid core, and by a combination of solid body and annular gas jet were treated. The investigation was limited to small angles of incidence. Qualitative results are obtained for the representation of a gas propulsive jet. Accurate simulation is obtained in the case of stage separation without simultaneous ignition of an upper stage engine. Author (ESA)

N80-12037# European Space Agency, Paris (France).
THE NORMAL FORCE ON A CRUCIFORM MISSILE AT BANK ANGLES OF A DEG AND 45 DEG c02
Helmut Esch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 45-60 refs Transl. into ENGLISH from "Die Normalkraft eines Flugkoerpers mit Kreuzleitwerk bei Rollagen von o deg und 45 deg," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Force and pressure distribution measurements were made on a body-tail combination to investigate the influence of bank angle on the normal force. A subsonic Mach number and supersonic Mach numbers between 2 and 4 were investigated for incidence angles up to 19 deg. The experimental data is compared with results from simple theoretical methods. It is shown that the normal force on a cruciform tail is more strongly decreased for x attitude than for + attitude. This is due to the separated body cortices that occur. Author (ESA)

N80-12038# European Space Agency, Paris (France).
INFLUENCE OF THE FLOW FIELD AROUND AN INCLINED OGIVE-CYLINDER BODY UPON SUPERSONIC AFT-INTAKES c02
Klaus Triesch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 61-78 refs Transl. into ENGLISH from "Einfluss des Rumpfes auf am Flugkoerperheck angeordnete Ueberschall-leinlaeufe bei Anstellung," DFVLR, Cologne Report DLR-FB-77-36 Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The measured pitot-pressure distributions are reproduced as a function of incidence at a plane 10 diameters behind the body apex of an inclined body at a Mach number of 2.0. The boundary layer distribution and position of the separated body vortices can be inferred from the measurements. By integration of the pitot-pressure the determination of the intake behavior of a ram jet at the rear of the body is investigated. A comparison between calculation and intake measurements shows good overall agreement. Potential improvements in the procedure are discussed. Author (ESA)

N80-12039# European Space Agency, Paris (France).
NORMAL FORCE DERIVATIVE AND CENTER OF PRESSURE MOVEMENT DUE TO MACH NUMBER ON WING-BODY COMBINATIONS WITH TRIANGULAR WINGS OF THE SAME SPAN AND DIFFERENT ASPECT RATIOS AT SUPERSONIC SPEEDS c02
Wolfgang Wyborny *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 79-96 refs Transl. into ENGLISH from "Normalkraftanstieg und Verschiebung des Luft-kraftangriffspunktes ueber der Machzal von Rumpf-Leitwerk-Kombinationen mit Rechenleitwerken gleicher Spannweite bei verschiedenen Flaechenverhaeltnissen im Ueberschall," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Experimental results from wind tunnel measurements on 'wing-body' combinations at Mach numbers of 1.57, 2.25, 2.89 and 4.15 at small angles of attack are compared with calculated results obtained using a semi-empirical method, based on linearized supersonic theory, slender body theory and empirical data. The parameters, other than Mach number, are the aspect ratio of the triangular wing (b square/F between 0.75 and 1.75) and the wing sweepback angle. The models consist of a cylindrical body of diameter D = 30 mm with an ogival forebody, whose radius in the first case is 2.5 D and in the second is 7.5 D. The total length of the model is therefore, in the first case, L = 12 D while in the second, it is L = 7.9 D. The span of the exposed triangular wings is B = 1.5 D. Author (ESA)

N80-12040# European Space Agency, Paris (France).
FLOW FIELD INVESTIGATIONS IN CORNER REGIONS IN HYPERSONIC FLOW Final Report c02
Hermann-Josef Schepers and Heinz Pfeiffer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 97-109 refs Transl. into ENGLISH from "Stroemungsfelduntersuchung in Eckengebieten bei Hyperschallanstroemung', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
(Proj. B8)
Avail: NTIS HC A15/MF A01

Results are presented for the investigations of the flow over three different configurations of streamwise-oriented corners. The experiments were performed in a hypersonic wind tunnel at a free stream Mach number of M = 8.8. The measurements of pitot pressure, static pressure and stagnation temperature in the flow field are presented which enable the flow quantities in complex flow regions to be determined. A semi-empirical calculation method based on known shock relations showed good agreement with the experiment for the flow quantities behind curved secondary shocks. Author (ESA)

N80-12041# European Space Agency, Paris (France).
LASER-RAMAN SPECTROSCOPY c02
Werner Krahn *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 110-127 refs Transl. into ENGLISH from "Laser-Raman Spektroskopie', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Pulsed laser-Raman spectroscopy is studied as a method for making nonintrusive local flow field measurements. An argon ion laser was used to record the rotational Raman spectrum of air, nitrogen, and oxygen. The use of a pulsed laser for measurements of gas concentrations and combustion temperatures is discussed as well as data interpretation problems.
Author (ESA)

N80-12042# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC DENSITY, TEMPERATURE AND PRESSURE PROFILES FOR WINTER ANOMALOUS CONDITIONS AT HEIGHTS BETWEEN 62 AND 117 KM c46
Demetrius G. Papanikas, Jochen Baete, Manfred Becker, and Uwe Niederloehner *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 128-167 refs Transl. into ENGLISH from "Ermittlung der atmosphaerischen Dichter-, Temperatur- und Druckverteilun-

gen bei winteranomalen zustaenden in Hoehen zwischen 52 and 117 km', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Pitot pressures were measured continuously during the flight of a Skylark high altitude rocket by means of two pressure measuring instruments which were mounted with six other experimental units in the rocket payload. Two rocket flights took place during winter anomalous conditions on 4th and 21st January 1976 in Huelva, Spain. In preparation for the flights, calibration tests and simulation measurements for the experiment described were carried out in a low density wind tunnel. Author (ESA)

N80-12043# European Space Agency, Paris (France).
SIMILARITY IN NOZZLE FLOWS WITH VIBRATIONAL NONEQUILIBRIUM **c34**
Nimai K. Mira and Martin Fiebig *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 168-184 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Requirements for similarity for vibrationally relaxing flows of pure gases or gas mixtures of CO2-N2-He as found in a gasdynamic laser in geometrically similar nozzles were investigated. Nondimensionalization of the basic flow equations shows that exact similarity for two cases requires identical composition of the flow media, identical stagnation chamber temperatures, and identical values of the product of the stagnation chamber pressure and the throat height. Inclusion of viscosity does not generally require any additional constraint. The stringent requirements of exact similarity were relaxed to obtain approximate similarity when the requirement of identical stagnation chamber temperature for two cases is not necessary. The characteristic Damkoehler number is shown to be the parameter for approximate similarity for the frozen vibrational temperature at the nozzle exit. Author (ESA)

N80-12044# European Space Agency, Paris (France).
MIXING LENGTH MODEL FOR COMPRESSIBLE TURBULENT FLOWS IN ROUGH CHANNELS **c34**
Wilhelm A. Neuberger *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 185-217 refs Transl. into ENGLISH from 'Ein Mischungsweg modell fuer kompressible turbulente Stroemungen in rauhen Kanaelen', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Compressible turbulent flow in a rough channel, which possesses the character of a developing flow when heat is continuously introduced over the length of the channel, is studied. The velocity and the temperature field, as well as the axial variation of the pressure, the friction factor, and the Stanton number in such a thermally developing flow are calculated. The turbulent contributions to the momentum and the energy transport are determined using a mixing length model. The free parameters occuring in the mixing length model are determined so that the calculations correctly describe the limiting case of a fully developed incompressible flow in a smooth or rough pipe. A correlation between the mixing length of the hypothetical rough wall and the relative sand grain roughness is developed. The effect of compressibility on the friction factor and the Stanton number is examined. Author (ESA)

N80-12045# European Space Agency, Paris (France).
CURVATURE EFFECTS ON THE BEHAVIOR OF LAMINAR BOUNDARY LAYERS **c02**
Roger Grundmann and Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 217-229 refs Transl. into ENGLISH from 'Kruemmungseinfluesse auf das Ablaeseverhalten von laminaren Grenzschichten', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

Numerical investigations of laminar boundary layers around strongly curved wall surfaces are described. The flow is around an elliptic cylinder with different angles of incidence. The development of thin or already thickened boundary layers in the maximum curvature nose region is analyzed. Calculations are performed by means of a multi-point difference scheme using second order boundary layer equations. The equations are switched to first or zeroth order (Prandtls equations). The three theories yield identical results for high Reynolds numbers. For Reynolds numbers in the intermediate range a higher order theory must be used, whereas for low Reynolds numbers the conventional second order boundary layer equations are not sufficient to describe the flow field adequately. Author (ESA)

N80-12046# European Space Agency, Paris (France).
VERIFICATION OF THE EXPERIMENTALLY DETERMINED LAMINAR-TURBULENT TRANSITION ON A SWEPT WING **c02**
Ernst Heinrich Hirschel and Vera Jawtusch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 229-250 refs Transl. into ENGLISH from Nachrechung des experimentell ermittelten Uebergangs laminar-turbulent an einem gepfeilten Fluegel, DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Sponsored in part by German Res. Council (DFG) (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

An investigation of the location of the transition line on a finite tapered swept wing is presented in order to make assertions about known stability and transition criteria. For the suction and the pressure side of the wing for different angles of attack. The boundary layer is calculated with panel method results as an external flow field. The boundary layer in calculated using the approximation locally infinite swept wing. The stability and transition criteria are applied to this boundary layer. A comparison of the experimental with the theoretical results shows the need for further experiments, as well as extended correlation investigations, in order to improve the prediction possibilities for the laminar-turbulent transition in three dimensional boundary layers. Author (ESA)

N80-12047# European Space Agency, Paris (France).
A COMPUTATIONAL METHOD FOR CALCULATING LAMINAR-TURBULENT TRANSITION IN A BOUNDARY LAYER **c02**
Ulrich Nehring *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 251-273 refs Transl. into ENGLISH from "Ein Verfahren zur Berechnung des laminar-trubulenten Uebergangs in der Grenzschicht," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

An implicit finite difference method for the calculation of the compressible, two dimensional, steady boundary layer in the transition region between laminar and turbulent flow is presented and discussed. The turbulence model is a single variable model which is defined by the turbulent kinetic energy equation and empirical assumptions. The introduction of a streamwise changing parameter, which determines the development of the characteristic lengths, such as the mixing length is discussed. The effect of molecular viscosity in regions of low turbulent Reynolds numbers and the damping of the turbulence near the wal is determined. The practical calculation determines the transition process as a function of the freestream turbulence and the external pressure field. Preliminary numerical tests were carried out for the incompressible flow on a flat plate. Author (ESA)

N80-12048# European Space Agency, Paris (France).
HIGHER-ORDER BOUNDARY LAYER EQUATIONS FOR THREE-DIMENSIONAL COMPRESSIBLE FLOW **c02**
Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 273-288 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The shell geometrical concept is discussed within the framework of general tensor analysis. A method based upon this concept is presented to derive higher order boundary layer equations for compressible flow. Different approximations are obtained. Author (ESA)

N80-12049# European Space Agency, Paris (France).
THREE-DIMENSIONAL, INVISCID, ROTATIONAL DUCT FLOWS WITH EMBEDDED SHOCKS: CONSIDERATIONS WITH REGARD TO A COMPUTATIONAL METHOD AND PRELIMINARY RESULTS **c02**
Kurt Gruemmer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 289-300 refs Transl. into ENGLISH from "Dreidimensionale, reibungsfreie, drehungsbehaftete innenstroemungen mit

eingebetteten Stoessen - Ueberlegungen zu einem Berechnungsverfahren, erste Rechenergebnisse." DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

A short discussion of the problem of the computation of supersonic inlet diffusers is followed by some preliminary calculation results. The flow in a plane symmetric inlet diffuser is calculated up to the first intersection of shock surfaces. The oncoming flow is considered to be both rotational as well as nonrotational. The results show that for rotational oncoming flow theprofiles of the total pressure at the final cross section considered are quite similar to each other for linear, convex and concave wall contours. Author (ESA)

N80-12060*# European Space Agency, Paris (France).
SHOCK-SHOCK AND SHOCK-BOUNDARY LAYER INTERACTION AT FLAT AND INCLINED PLATES IN RAREFIELD HYPERSONIC FLOW c02
Gustav Schweiger, Knut Erhardt, Manfred Becker, and Demetrius G. Papanikas *In its* Contrib. to Gas Dyn. and Aerodyn. 1979 p 301-328 refs Transl. into ENGLISH from "Stoss-Stoss-und Stoss-Grenzschicht-Wechselwirkung an ebenenund angestellten Platten in verdueennter Hyperschallstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

The interaction phenomena between shock and boundary layer at flat and inclined plates and between cylinder shock and plate shock are experimentally described by the recording of plate surface pressures and profiles of pitot pressure, rotational temperature, and density. A strong upstream influence from the interaction regions and total mixing downstream was found. The rarefaction of the flow (mean free paths greater than 1 mm) was used as a geometric means for magnifying the interaction events. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-12061 New York Univ., N. Y.
AN ARTIFICIAL VISCOSITY METHOD FOR THE DESIGN OF SUPERCRITICAL AIRFOILS Ph.D. Thesis
Geoffrey B. McFadden 1979 167 p
Avail: Univ. Microfilms Order No. 7925492

An inverse method for the numerical design of supercritical airfoils is presented. The speed distribution along the surface of the desired profile is prescribed and the shape required to generate such a profile is computed. In contrast to other approaches to the design problem that employ the hodograph transformation, this technique does not produce shockless solutions. Instead, an artificial viscosity is used to inhibit the formation of shocks in the flow during the design procedure with the result that weak shocks may appear in the actual flow past the profile. By choosing the prescribed velocity distribution correctly, the wave drag associated with these shocks is small and airfoils can be obtained that compare favorably with shockless airfoils in their overall performance. Dissert. Abstr.

N80-12062 Dayton Univ., Ohio.
DEVELOPMENT OF STABILITY METHODS FOR APPLICATION TO NONLINEAR AEROELASTIC OPTIMIZATION Ph.D. Thesis
Ronald Franklin Taylor 1979 192 p
Avail: Univ. Microfilms Order No. 7925694

An approximate procedure is developed which determines the amplitude dependent stability of nonlinear systems. This procedure, the method of imposed disturbances, is shown to be applicable to studies of the sensitivity of nonlinear aeroelastic systems to changes in design variables. Emphasis is placed on airfoil and panel flutter instabilities in aerodynamically nonlinear flow. The method is applied to nonlinear transonic flutter and divergence of a two dimensional airfoil. Airloads are predicted using an existing small disturbance computer code, which determines structural loads due to airflow containing moving shock waves. A nonlinear two degree of freedom follower load problem is studied to demonstrate the applicability of the method of imposed disturbances to a multiple degree of freedom system. Another multiple degree of freedom system examined is a sandwich panel in nonlinear hypersonic flow, for which the rate of change of limit amplitude with respect to structural design variables is studied. Dissert. Abstr.

N80-12063*# Wichita State Univ., Kans.
WIND TUNNEL FORCE AND PRESSURE TESTS OF A 21% THICK GENERAL AVIATION AIRFOIL WITH 20% AILERON, 25% SLOTTED FLAP AND 10% SLOT-LIP SPOILER
W. H. Wentz, Jr. and K. A. Fiscko Washington NASA Jun. 1979 114 p refs
(Grant NsG-1165)
(NASA-CR-3081; WSU-AR-77-6) Avail: NTIS HC A06/MF A01 CSCL 01A

Force and surface pressure distributions were measured for the 21% LS(1)-0421 modified airfoil fitted with 20% aileron, 25% slotted flap and 10% slot lip spoiler. All tests were conducted at a Reynolds number of 2.2 x 10 to the 6th power and a Mach number of 0.13. The lift, drag, pitching moments, control surface normal force and hinge moments, and surface pressure distributions are included in the results. Incremental performance of flap and aileron are discussed and compared to the GA(W)-2 airfoil. Spoiler control which shows a slight reversal tendency at high alpha, is examined. A.W.H.

N80-12064*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
TWO-DIMENSIONAL WIND-TUNNEL TESTS OF A NASA SUPERCRITICAL AIRFOIL WITH VARIOUS HIGH-LIFT SYSTEMS. VOLUME 1: DATA ANALYSIS
E. Omar, T. Zierten, and A. Mahal Washington NASA Apr. 1977 87 p refs
(Contract NAS1-10824)
(NASA-CR-2214; D6-41063-1-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01A

High-lift systems for a NASA, 9.3%, method for calculating the viscous flow about two-dimensional multicomponent airfoils was evaluated by comparing its predictions with test data. High-lift systems derived from supercritical airfoils were compared in terms of performance to high-lift systems derived from conventional airfoils. The high-lift systems for the supercritical airfoil were designed to achieve maximum lift and consisted of: a single-slotted flap; a double-slotted flap and a leading-edge slat; and a triple-slotted flap and a leading-edge slat. Agreement between theoretical predictions and experimental results are also discussed. R.C.T.

N80-12065*# Boeing Co., Seattle, Wash.
TWO-DIMENSIONAL WIND-TUNNEL TESTS OF A NASA SUPERCRITICAL AIRFOIL WITH VARIOUS HIGH-LIFT SYSTEMS. VOLUME 2: TEST DATA Final Report
E. Omar, T. Zierten, M. Hahn, E. Szpiro, and A. Mahal Washington NASA Apr. 1977 234 p
(Contract NAS1-10824)
(NASA-CR-2215; D6-41063-2-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 01A

Three high lift systems for a 9.3 percent blunt based, supercritical airfoil were designed, fabricated, and wind tunnel tested. A method for calculating the viscous flow about two dimensional multicomponent airfoils was evaluated by comparing its predictions with test data. A comparison of high lift systems derived from supercritical airfoils with high lift systems derived from conventional airfoils is presented. The high lift systems for the supercritical airfoil were designed to achieve maximum lift and consisted of: (1) a single slotted flap, (2) a double slotted flap and a leading edge slat, and (3) a triple slotted flap and a leading edge slat. Aerodynamic force and moment data and surface pressure data are presented for all configurations and boundary layer and wake profiles for the single slotted flap configuration. The wind-tunnel models, test facilities and instrumentation, and data reduction are described. Author

N80-12056*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROGRAM FOR CALCULATING LOAD COEFFICIENT MATRICES UTILIZING THE FORCE SUMMATION METHOD, L218 (LOADS). VOLUME 1: ENGINEERING AND USAGE
R. D. Miller and L. R. Anderson Oct. 1979 143 p refs
(Contract NAS1-13918)
(NASA-CR-2853; D6-44462-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01A

The LOADS program L218, a digital computer program that calculates dynamic load coefficient matrices utilizing the force summation method, is described. The load equations are derived for a flight vehicle in straight and level flight and excited by gusts and/or control motions. In addition, sensor equations are calculated for use with an active control system. The load coefficient matrices are calculated for the following types of loads: translational and rotational accelerations, velocities, and displacements; panel aerodynamic forces; net panel forces; shears and moments. Program usage and a brief description of the analysis used are presented. A description of the design and structure of the program to aid those who will maintain and/or modify the program in the future is included. F.O.S.

N80-12057*# Boeing Commercial Airplane Co., Seattle, Wash.
EQUATION MODIFYING PROGRAM, L219 (EQMOD). VOLUME 1: ENGINEERING AND USAGE Contractor Report, May 1975 - May 1977
R. D. Miller, R. J. Fraser, M. Y. Hirayama, and R. E. Clemmons Oct. 1979 139 p refs
(Contract NAS1-13918)
(NASA-CR-2855; D6-44464-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01A

The analysis and use of the Equation Modifying Program (EQMOD) L219, digital computer program which modifies matrices according to specific instructions was described. The program modifies the theoretical equation of motion and load equations generated by the DYLOFLEX programs Equation of Motion L217 (EOM), and Load Equations, L218 (LOADS), respectively. R.C.T.

N80-12058*# Boeing Commercial Airplane Co., Seattle, Wash.
RANDOM HARMONIC ANALYSIS PROGRAM, L221 (TEV156). VOLUME 1: ENGINEERING AND USAGE Contractor Report, May 1975 - May 1977
R. D. Miller and M. L. Graham Oct. 1979 158 p refs
(Contract NAS1-13918)
(NASA-CR-2857; D6-44466) Avail: NTIS HC A08/MF A01 CSCL 01A

A digital computer program capable of calculating steady state solutions for linear second order differential equations due to sinusoidal forcing functions is described. The field of application of the program, the analysis of airplane response and loads due to continuous random air turbulence, is discussed. Optional capabilities including frequency dependent input matrices, feedback damping, gradual gust penetration, multiple excitation forcing functions, and a static elastic solution are described. Program usage and a description of the analysis used are presented. A.W.H.

N80-12059*# General Dynamics/Convair, San Diego, Calif. Convair Div.
WIND TUNNEL INVESTIGATION OF AN OBLIQUE WING TRANSPORT MODEL AT MACH NUMBERS BETWEEN 0.6 AND 1.4
R. L. Black, J. K. Beamish, and W. K. Alexander Jul. 1975 334 p refs
(Contract NAS2-8127)
(NASA-CR-137697; HST-TR-344-0) Avail: NTIS HC A15/MF A01 CSCL 01A

Models of three practical oblique-wing transport configurations were tested in the NASA Ames 11 foot wind tunnel. The three configurations used a common forward fuselage, wing, and support system but employed different aft fuselage sections simulating alternate propulsion system installations. These included an integrated propulsion system, pylon-mounted nacelles, and clean (no propulsion system) configuration. The tests were conducted over a Mach number range from 0.6 to 1.4 and at sweep angles from 0 to 60 degrees. The nominal unit Reynolds number was 1.83 million per meter and the angle of attack range was -3 to +6 degrees. The models were mounted in the tunnel by means of a lower blade support system. The interference effects of this lower blade and the flow inclination were determined by using an image blade system and testing the configuration in both the upright and inverted positions. M.M.M.

N80-12060*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEGREES TO 35 DEGREES, 3. EFFECT OF WING LEADING-EDGE MODIFICATIONS, MODEL A
William Bihrle, Jr. and William Mulcay Nov. 1979 176 p refs
(Contract NAS1-14849)
(NASA-CR-3102) Avail: NTIS HC A05/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/5 scale, single-engine, low-wing, general aviation airplane model. The configurations tested included the basic airplane, sixteen wing leading-edge modifications and lateral-directional control settings. Data are presented for all configurations without analysis for an angle of attack range of 8 deg to 35 deg and clockwise and counter-clockwise rotations covering an Omega b/2v range from 0 to 0.85. Also, data are presented above 35 deg of attack for some configurations. Author

N80-12061*# Kansas Univ. Center for Research, Inc., Lawrence.
AN IMPROVED WOODWARD'S PANEL METHOD FOR CALCULATING LEADING-EDGE AND SIDE-EDGE SUCTION FORCES AT SUBSONIC AND SUPERSONIC SPEEDS
C. Edward Lan and Sudhir C. Mehrotra Nov. 1979 37 p refs
(Grant NsG-1046)
(NASA-CR-3205; CRINC-FRL-268-3) Avail: NTIS HC A03/MF A01 CSCL 01A

Woodward's panel method for subsonic and supersonic flow was improved by employing control points determined by exactly matching two-dimensional pressure at a finite number of points. The results show great improvement in the predicted pressure distribution of a flapped airfoil. With the paneling scheme of cosine law in both chordwise and spanwise directions, the method is shown to accurately predict leading edge and side edge suction forces of various configurations in subsonic and supersonic flow. R.C.T.

N80-12062# Aeronautical Research Labs., Melbourne (Australia).
EVALUATION OF WALL INTERFERENCE EFFECTS IN A TWO-DIMENSIONAL TRANSONIC WIND TUNNEL BY SUBSONIC LINEAR THEORY
B. D. Fairlie and N. Pollock Feb. 1979 74 p refs
(ARL/Aero-Rept-151; AR-001-596) Avail: NTIS HC A04/MF A01

Results of transonic wind tunnel tests on two-dimensional aerofoils are analyzed with respect to the effects of wind tunnel wall interference. The tests were conducted on two geometrically similar models of each of two aerofoil sections--the NACA 0012 and the BGK-1 sections--and covered a range of Mach numbers from 0.5 to 0.82 with model chord to tunnel height ratios of 0.125 and 0.25. Measurements on all models in both solid and slotted wall test sections are corrected for wind tunnel wall interference effects by the application of classical linearized theory. For the solid wall results, these corrections appear to produce data which are very close to being free of the effects of interference. In the case of slotted walls however, linear theory is found to significantly underestimate the magnitude of blockage interference. The introduction of an empirical blockage correction, when combined with the linear theory representation of lift-interference, enables the cross-flow characteristics of the slotted walls to be determined, and leads to a successful correction scheme for the slotted wall results. Extensive comparisons with data from other sources, both experimental and theoretical, provide further verification that the corrected results are closely interference free. Author

N80-12063# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC WIND TUNNEL TESTS ON A SERIES OF TWO-DIMENSIONAL AEROFOILS IN A SOLID WALL TEST SECTION
B. D. Fairlie and N. Pollock Jan. 1979 39 p refs

(ARL/Aero-Note-384; AR-001-330) Avail: NTIS HC A03/MF A01

Transonic wind tunnel tests are reported on a series of two dimensional models in a test section equipped with four solid walls. The tests conducted on two geometrically similar models of each of two aerofoil sections, are described. The validity of linear interference theory without the complication of the unknown boundary conditions associated with nonsolid wind tunnel walls is examined. A.W.H.

N80-12064*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DOUBLE-DELTA WING AT MACH NUMBERS FROM 0.80 TO 1.20, WITH SUMMARY OF DATA FROM 0.20 TO 6.0

Jim A. Penland, James B. Hallissy, and James L. Dillon Washington Dec. 1979 147 p refs

(NASA-TP-1552; L-13158) Avail: NTIS HC A07/MF A01 CSCL 01A

The static longitudinal, lateral, and directional stability characteristics of a hypersonic research airplane concept having a 70 deg swept double-delta wing were investigated. Force tests were conducted in the Langley 8 foot transonic pressure tunnel for a Reynolds number (based on fuselage length) range of 6.30 x 10 to the 6th power to 7.03 x 10 to the 6th power, at angles of attack from about -4 deg to 23 deg, and at angles of sideslip of 0 deg and 5 deg. The configuration variables included the wing planform, tip fins, the center vertical tail, and scramjet engine modules. Variations of the more important aerodynamic parameters with Mach number for Mach numbers from 0.20 to 6.0 are summarized. A state-of-the-art example of theoretically predicting performance parameters and static longitudinal and directional stability over the Mach number range is included. A.R.H.

N80-12065*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

APPLICATION OF SUPERSONIC LINEAR THEORY AND HYPERSONIC IMPACT METHODS TO THREE NONSLENDER HYPERSONIC AIRPLANE CONCEPTS AT MACH NUMBERS FROM 1.10 TO 2.86

Jimmy L. Pittman Washington Dec. 1979 59 p refs

(NASA-TP-1539; L-13142) Avail: NTIS HC A04/MF A01 CSCL 10A

Aerodynamic predictions from supersonic linear theory and hypersonic impact theory were compared with experimental data for three hypersonic research airplane concepts over a Mach number range from 1.10 to 2.86. The linear theory gave good lift prediction and fair to good pitching-moment prediction over the Mach number (M) range. The tangent-cone theory predictions were good for lift and fair to good for pitching moment for M more than or equal to 2.0. The combined tangent-cone theory predictions were good for lift and fair to good for pitching moment for M more than or equal to 2.0. The combined tangent-cone/tangent-wedge method gave the least accurate prediction of lift and pitching moment. The zero-lift drag was overestimated, especially for M less than 2.0. The linear theory drag prediction was generally poor, with areas of good agreement only for M less than or equal to 1.2. For M more than or equal to 2.), the tangent-cone method predicted the zero-lift drag most accurately. R.C.T.

N80-12066*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PITOT PRESSURE MEASUREMENTS IN FLOW FIELDS BEHIND CIRCULAR-ARC NOZZLES WITH EXHAUST JETS AT SUBSONIC FREE-STREAM MACH NUMBERS

Mary L. Mason and Lawrence E. Putnam Washington Dec. 1979 60 p refs

(NASA-TM-80169; L-13060) Avail: NTIS HC A04/MF A01 CSCL 01A

The flow field behind a circular arc nozzle with exhaust jet was studied at subsonic free stream Mach numbers. A conical probe was used to measure the pitot pressure in the jet and free stream regions. Pressure data were recorded for two nozzle configurations at nozzle pressure ratios of 2.0, 2.9, and 5.0. At each set of test conditions, the probe was traversed from the jet center line into the free stream region at seven data acquisition stations. The survey began at the nozzle exit and extended downstream at intervals. The pitot pressure data may be applied to the evaluation of computational flow field models, as illustrated by a comparison of the flow field data with results of inviscid jet plume theory. R.C.T.

N80-12067# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

EFFECT OF HORIZONTAL AND VERTICAL SIDE FORCES AND MOMENTS ON STABILITY OF A SYMMETRIC MISSILE IN ASCENDING OR DESCENDING FLIGHT Final Report

Charles H. Murphy Apr. 1979 30 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A072808; ARBRL-MR-02915; AD-E430280) Avail: NTIS HC A03/MF A01 CSCL 19/4

Lloyd and Brown have shown that constant horizontal and vertical side forces and moments applied to a spinning projectile can result in dynamic instability. This instability arises from the nonlinear terms in the fixed-plane coordinate system spin that appear in the equations of motion. By quasilinearization, these nonlinear terms are shown to affect the frequencies slightly but the damping rates not at all. By the use of the fixed-plane system (rather than Lloyd and Brown's nonrolling system) simpler relations can be developed, the full effects of gravity, drag and roll damping obtained and the limitation to large gyroscopic stability factors removed. Very simple stability bounds are given for a slowly spinning or nonspinning finned missile such as Copperhead. GRA

N80-12068# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

DESIGN AND ANALYSIS OF SINGLE CELL BALLOONS

James L. Rand Aug. 1978 81 p refs

(Contract F19628-76-C-0082; AF Proj. 6665)

(AD-A072828; AFGL-TR-78-0258; Scientific-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

The procedures used in the design and analysis of single cell balloons are reviewed and reformulated to include lobing between load tapes and a realistic model of the load transfer mechanism between load carrying members. Results are presented for a typical 'heavy' load balloon which reveals the existence of significant circumferential stresses near the edge of the cap under certain conditions. Results also suggest a more severe state of stress below the design altitude than above. GRA

N80-12069# Calspan Advanced Technology Center, Buffalo, N.Y.

TRESTLE WIND TUNNEL STUDY Final Report, Sep. 1977 - Aug. 1978

Gary R. Ludwid and Joseph P. Nenni Mar. 1979 255 p refs

(Contract F29601-77-C-0093)

(AD-A072791; AFWL-TR-78-184; AD-E200340; Calspan-6171-A-2) Avail: NTIS HC A12/MF A01 CSCL 20/4

This report presents the results of an experimental and analytical study to determine the effects of atmospheric winds on aircraft situated on the ramp and test stand of the TRESTLE facility which is being built at Kirtland Air Force Base, New Mexico. The program included model tests to determine the wind flow patterns around the TRESTLE facility and the use of the wind flow data in an analysis to predict the effects of these winds on various large aircraft. The model tests, which were conducted in the Calspan Atmospheric Simulation Facility, included flow visualization studies and quantitative hot-film anemometer measurements of three components of mean velocity. A simplified method of analysis was developed to estimate the forces and moments on aircraft situated in the experimentally determined flow field. The analysis incorporated provisions to account for unconventional wind-aircraft orientations and nonuniform flow fields. Results of the program are presented for twelve wind directions, three different aircraft, and nine positions of each aircraft on the TRESTLE facility ramp and test stand. GRA

N80-12070# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

TURBULENT BOUNDARY LAYERS ON AN AIRFOIL IN SEVERAL ADVERSE PRESSURE GRADIENTS M.S. Thesis Final Report, 1 Jan. 1977 - 30 Jun. 1978
Richard T. Cervisi Aug. 1978 135 p refs
(Contract F49620-77-C-0031; AF Proj. 2307)
(AD-A072839; AFOSR-78-1450TR; MIT-TR-203) Avail: NTIS HC A07/MF A01 CSCL 20/4

Turbulent boundary layer profiles in a wide range of adverse pressure gradients were measured using a boundary layer velocity-flow angle measuring probe designed for this experiment. The different pressure gradients were created on a NACA 0012 airfoil by changing the angular orientation of an elliptic cylinder placed near the airfoils trailing edge. Rotating the elliptic cylinder to various angular positions changed the effective angle of attack and camber of the airfoil-ellipse combination thereby creating different pressure distributions about the airfoil. In anticipation of spinning the ellipse to create an unsteady flow in future experiments, this experiment defined the steady state environment. The boundary layer profiles are presented in three different graphical formats; conventional nondimensional plots, profiles in modified Law of the Wall coordinates and Velocity Defect Law graphs. The Law of the Wall was modified to account for longitudinal streamline curvature. Local skin friction coefficients were found using the modified Law of the Wall in the form of a Clauser chart. The boundary layer data was checked for repeatability, consistency and agreement with theory and previous experiments. The final results were deemed excellent. GRA

N80-12071# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
IMPROVEMENTS TO THE SOLUTION OF THE VISCOUS SHOCK LAYER EQUATIONS Final Report, Jan. 1977 - Oct. 1978
W. M. Hosny, R. T. Davis, and M. J. Werle Aug. 1979 115 p refs
(Contract F40600-77-C-0001)
(AD-A072673; AFL-78-11-45; AEDC-TR-79-25) Avail: NTIS HC A06/MF A01 CSCL 20/4

An analysis and numerical solution of the fully viscous shock layer equations for hypersonic flow past blunt nosed bodies is presented. Solutions were obtained using a numerical scheme developed to solve the governing equations simultaneously as a coupled set of equations. Through application of the method to hypersonic flow past hyperboloids, it was found that the method is stable and produces results in good comparison with other methods. The main success of the method lies in its ability of extending the flow field calculations far aft of the nose region. GRA

N80-12072# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A METHOD FOR ASSESSING THE IMPACT OF WAKE VORTICES OF USAF OPERATIONS Final Report, 15 Dec. 1978 - 5 Apr. 1979
George Kurylowich Jul. 1979 111 p refs
(AD-A072967; AFFDL-TR-79-3060) Avail: NTIS HC A06/MF A01 CSCL 01/2

Experience as a consultant to the Safety Office at Norton AFB led to compiling the engineering tools presented, so that this report can be used by engineering personnel to investigate future incidents/accidents and existing USAF operations that are impacted by the vortical wake hazard. The approach presented is amenable to easy hand computations. Mixed airplane/helicopter operations can be assessed, since the engineering tools to determine the location and strength of the rotor downwash field behind a helicopter are presented. Finally, a simplified mathematical model is given to represent this hazard for use in USAF simulators, to make pilots aware of the problems associated with operating in wake-contaminated airspace. GRA

N80-12073# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
AEROELASTIC RESPONSE ANALYSIS OF TWO DIMENSIONAL, SINGLE AND TWO DEGREE OF FREEDOM AIRFOILS IN LOW-FREQUENCY, SMALL-DISTURBANCE UNSTEADY TRANSONIC FLOW Final Report, Nov. 1978 - May 1979
T. Y. Yang, P. Guruswamy, and A. G. Striz Wright-Patterson AFB, Ohio AFFDL Jun. 1979 55 p refs
(Grant AF-AFOSR-3523-78; AF Proj. 2307)
(AD-A073379; AFFDL-TR-79-3077) Avail: NTIS HC A04/MF A01 CSCL 20/4

A procedure is developed to obtain the aeroelastic responses of single and two degree of freedom aeroelastic systems in transonic flow. The fluid is described by the two dimensional unsteady low-frequency transonic potential equation based on small disturbance theory. The aerodynamic computer code LTRAN2 which is based on a fully implicit time integration scheme is employed to obtain the aerodynamic forces. The structural equations are simultaneously integrated with the potential flow equations by a numerical method and the aeroelastic responses are obtained. Results for neutrally stable responses are compared with those obtained by the U-g method. Aeroelastic responses are obtained for flat plates (single and two degree of freedom) at M = 0.7 by the linear part of LTRAN2. Examples of an NACA 64A006 airfoil at Mach numbers of 0.88 and 0.85 are also analyzed. Response results obtained for a single pitching degree of freedom system at M = 0.88 are compared with an existing solution. The response results obtained for a two degree of freedom system at M = 0.85 for neutrally stable condition are correlated with those obtained by the flutter analysis. Results also include stable and unstable response curves and their variations with altitude. GRA

N80-12074*# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF SEPARATED FLOW ABOUT A HEMISPHERE-CYLINDER AT 0- TO 19- DEGREE IN THE MACH NUMBER RANGE FROM 0.6 TO 1.5 Final Report, Oct. 1974 - Jun. 1976
T. Hsieh AEDC Nov. 1976 121 p refs
(AF Proj. 8219)
(AD-A073451; AEDC-TR-76-112) Avail: NTIS HC A06/MF A01 CSCL 20/4

A wind tunnel investigation was conducted of the separated flow about a hemisphere-cylinder at incidence from 0 to 19 deg in the Mach number range from 0.6 to 1.5. At zero incidence, a nose separation bubble is revealed from analysis of shadowgraphs and surface pressure distributions between Mach numbers 0.7 and 0.9. The basic differences between the present nose separation bubble and the leading-edge separation bubble of airfoils are discussed. A multiple shock system, consisting of a lambda shape shock and two normal shocks, prevails in the flow field as a result of the viscous/inviscid interaction which is strongest at M sub infinity equals 0.85. Velocity field measurements utilizing a laser velocimeters were obtained for M at infinity equals 0.85. The concept of an effective body and the particle dynamics are used to analyze the velocity. For incidences from 5 to 19 deg, shadowgraphs, surface pressures, and oil flow pictures showing the separation patterns and limiting streamlines, were obtained through the Mach number range. Two separation regions, the nose separation bubble and the crossflow separation zone, were found to exist simultaneously. Concentrated vortices standing at the leeside forebody were found, and the mechanism and conditions for their appearance are discussed. GRA

N80-12075# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
REAL TIME DIGITAL MODEL OF A ROLLING AIRFRAME
Victor S. Grimes, Jr. 31 Jul. 1978 50 p refs
(DA Proj. 1X4-64306-D-646)
(AD-A073456; DRDMI-T-78-75) Avail: NTIS HC A03/MF A01 CSCL 20/4

An all-digital airframe model of a rolling missile is developed by using tunable convolution and integration techniques. The model is capable of handling high frequency airframe dynamics in real time with large time steps and hardware in the loop (HWIL). This model is currently in use in three applications at the MIRADCOM Advanced Simulation Center in Aeroballistics Directorate, Technology Laboratory. GRA

N80-12008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
UNSTEADY AERODYNAMIC INPUTS FOR AEROELASTIC ANALYSES: A GENERAL INTRODUCTION
W. Geissler *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design, 1979 102 p refs (For primary

document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12009# National Aerospace Lab., Amsterdam (Netherlands).
REMARKS ON THE TRANSONIC FLOW PAST OSCILLATING AIRFOILS
H. Tijdeman *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 33 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12014# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF TRANSONIC FLOWS AROUND WINGS
Jean-Jacques Chattot, Colette Coulombeix, and Carlos daSilvaT-ome *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 1-41 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 143-159 Original language report was announced as A79-11132 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12015# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF THE THREE-DIMENSIONAL SUPERSONIC FLOW IN AN AXIAL COMPRESSOR BY A METHOD OF CHARACTERISTICS
Jean Martinon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 42-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-4, Jul.-Aug. 1978 p 161-174 Original language report was announced as A79-11133 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12016# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION - EXPERIMENT COMPARISONS OF THE TRANSONIC TWO-DIMENSIONAL FLOW IN A HIGH-DEFLECTION CASCADE
Georges Meauze *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1978-4 Jun. 1979 p 79-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 175-180 Presented at Euromech. Colloq. 87 on Transonic Flows in Turbomachines, Prague, 12-15 Apr. 1977 Original language report was announced as A79-11134 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12022# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SEPARATION OF A FLOW ALONG A LINE OF A SMOOTH SURFACE
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 1-12 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 213-219 Original language report was announced as A79-18531 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL INVESTIGATION OF LARGE SCALE STRUCTURES IN TURBULENT JET MIXING LAYERS
Otto Leuchter and Khoa Dang *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 93-96 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 279-282 Presented at Working Group on Coherent Struct. and Turbulent Boundary Layers, Bethlehem, Penn. 1-3 May 1978 Original language report was announced as A79-18536 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12030# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONERA AERODYNAMIC RESEARCH WORK ON HELICOPTERS
Jean-Jacques Philippe and Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 1-23 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 287-304 Presented at AGARD Symp. on "Rotocraft Design", Moffett Field, Calif., 16-19 May 1977 Original language report was announced as N78-19148 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12031# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS OF THE SEPARATION DUE TO SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTION IN TRANSONIC FLOW
Jean Delery *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 23-45 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 305-320 Original language report was announced as A79-25074 Sponsored by DRET (Res. Directorate, Min. of Defence) (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12036# European Space Agency, Paris (France).
ON THE SIMULATION OF AN UNDEREXPANDED PROPULSIVE JET FOR THE WIND TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL STABILITY OF FLIGHT VEHICLES IN SUPERSONIC FLOW
Hans Emunds and Hansgeorg Riedel *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 15-44 refs Transl. into ENGLISH from 'Zur Simulation eines unterexpandierten Treibstrahls beider Untersuchung der statischen Laengsstabilitaet von Flugkoerpern im Windkanal bei Ueberschallanstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12037# European Space Agency, Paris (France).
THE NORMAL FORCE ON A CRUCIFORM MISSILE AT BANK ANGLES OF A DEG AND 45 DEG
Helmut Esch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 45-60 refs Transl. into ENGLISH from 'Die Normalkraft eines Flugkoerpers mit Kreuzleitwerk bei Rollagen von o deg und 45 deg," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12038# European Space Agency, Paris (France).
INFLUENCE OF THE FLOW FIELD AROUND AN INCLINED OGIVE-CYLINDER BODY UPON SUPERSONIC AFT-INTAKES
Klaus Triesch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 61-78 refs Transl. into ENGLISH from 'Einfluss des Rumpfes auf am Flugkoerperheck angeordnete Ueberschalleinlaeufe bei Anstellung," DFVLR, Cologne Report DLR-FB-77-36 Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12039# European Space Agency, Paris (France).
NORMAL FORCE DERIVATIVE AND CENTER OF PRESSURE MOVEMENT DUE TO MACH NUMBER ON WING-BODY COMBINATIONS WITH TRIANGULAR WINGS OF THE SAME SPAN AND DIFFERENT ASPECT RATIOS AT SUPERSONIC SPEEDS
Wolfgang Wyborny *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 79-96 refs Transl. into ENGLISH from 'Normalkraftanstieg und Verschiebung des Luftkrafttangriffspunktes ueber der Machzal von Rumpf-Leitwerk-Kombinationen mit Rochenleitwerken gleicher Spannweite bei verschiedenen Flaechenverhaeltnissen im Ueberschall," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12040# European Space Agency, Paris (France).
FLOW FIELD INVESTIGATIONS IN CORNER REGIONS IN HYPERSONIC FLOW Final Report
Hermann-Josef Schepers and Heinz Pfeiffer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 97-109 refs Transl.

into ENGLISH from "Stroemungsfelduntersuchung in Eckengebieten bei Hyperschallanstroemung", DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
(Proj. 88)
Avail: NTIS HC A15/MF A01

N80-12041# European Space Agency, Paris (France).
LASER-RAMAN SPECTROSCOPY
Werner Krahn *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 110-127 refs Transl. into ENGLISH from 'Laser-Raman Spektroskopie', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12045# European Space Agency, Paris (France).
CURVATURE EFFECTS ON THE BEHAVIOR OF LAMINAR BOUNDARY LAYERS
Roger Grundmann and Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 217-229 refs Transl. into ENGLISH from 'Kruemmungseinfluesse auf das Ablaeseverhalten von laminaren Grenzschichten', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12046# European Space Agency, Paris (France).
VERIFICATION OF THE EXPERIMENTALLY DETERMINED LAMINAR-TURBULENT TRANSITION ON A SWEPT WING
Ernst Heinrich Hirschel and Vera Jawtusch *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 229-250 refs Transl. into ENGLISH from Nachrechung des experimentell ermittelten Uebergangs laminar-turbulent an einem gepfeilten Fluegel, DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 Sponsored in part by German Res. Council (DFG) (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12047# European Space Agency, Paris (France).
A COMPUTATIONAL METHOD FOR CALCULATING LAMINAR-TURBULENT TRANSITION IN A BOUNDARY LAYER
Ulrich Nehring *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 251-273 refs Transl. into ENGLISH from "Ein Verfahren zur Berechnung des laminar-trubulenten Uebergangs in der Grenzschicht," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12048# European Space Agency, Paris (France).
HIGHER-ORDER BOUNDARY LAYER EQUATIONS FOR THREE-DIMENSIONAL COMPRESSIBLE FLOW
Klaus Robert *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 273-288 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12049# European Space Agency, Paris (France).
THREE-DIMENSIONAL, INVISCID, ROTATIONAL DUCT FLOWS WITH EMBEDDED SHOCKS: CONSIDERATIONS WITH REGARD TO A COMPUTATIONAL METHOD AND PRELIMINARY RESULTS
Kurt Gruemmer *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 289-300 refs Transl. into ENGLISH from "Dreidimensionale, reibungsfreie, drehungsbehaftete innenstroemungen mit eingebetteten Stoessen - Ueberlegungen zu einem Berechnungsverfahren, erste Rechenergebnisse," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12050# European Space Agency, Paris (France).
SHOCK-SHOCK AND SHOCK-BOUNDARY LAYER INTERACTION AT FLAT AND INCLINED PLATES IN RAREFIELD HYPERSONIC FLOW
Gustav Schweiger, Knut Erhardt, Manfred Becker, and Demetrius G. Papanikas *In its* Contrib. to Gas Dyn. and Aerodyn. 1979 p 301-328 refs Transl. into ENGLISH from "Stoss-Stoss-und Stoss-Grenzschicht-Wechselwirkung an ebenenund angestellten Platten in verduennter Hyperschallstroemung," DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12211 Institut Franco-Allemand de Recherches, St. Louis (France).
SHOCK TUBE RESEARCH LOOKING AT THE ORIGIN OF THE MACHWAVES INSIDE AND OUTSIDE SUPERSONIC JETS
H. Oertel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 167-208 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-12076*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TECHNOLOGY OPTIONS FOR AN ENHANCED AIR CARGO SYSTEM
Matthew M. Winston Oct. 1979 34 p refs Presented at the ASCE Natl. Convention, Atlanta, 22-26 Oct. 1979
(NASA-TM-80173) Avail: NTIS HC A03/MF A01 CSCL 01C

A view of potential enhancements to the air cargo system through technology application is provided. NASA's role in addressing deficiencies of the current civil and military air cargo systems is outlined. The evolution of conventional airfreighter design is traced and projected through the 1990's. Also, several advanced airfreighter concepts incorporating unconventional design features are described to show their potentials benefits. A number of ongoing NASA technology programs are discussed to indicate the wide range of advanced technologies offering potential benefits to the air cargo system. The promise of advanced airfreighters is then viewed in light of the future air cargo infrastructure predicted by extensive systems studies. The derived outlook concludes that the aircraft technology benefits may be offset somewhat by adverse economic, environmental, and institutional constraints. Author

N80-12077# Air Force Engineering and Services Center, Tyndall AFB, Fla.
AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD AT SELECTED UNITED KINGDOM BASES: RAF MILDENHALL, RAF ALCONBURY, RAF UPPER HEYFORD, RAF BENTWATERS, RAF FAIRFORD, RAF LAKENHEATH, AND RAF WOODBRIDGE Final Report, Nov. - Dec. 1978
James S. Kent, Joan Scott, and William H. Niemeier Jun. 1979 100 p refs
(AD-A073062; AFESC-TM-3-79) Avail: NTIS HC A05/MF A01 CSCL 01/2

Selected United Kingdom air bases were surveyed from 3 November to 4 December 1978 by the Air Force Engineering and Services Center's Bird/Aircraft Strike Hazard Team. During this period, operational and environmental factors which combine to create bird strike hazards at each location were observed. Specific recommendations based on observations are provided to reduce the bird strike hazard. GRA

N80-12078# Coast Guard Research and Development Center, Groton, Conn.
ANALYST LEVEL DOCUMENTATION FOR THE SEARCH AND RESCUE SIMULATION (SARSIM) Final Report
G. L. Underwood, J. A. Smith, and G. B. Walters Mar. 1979 85 p refs
(AD-A073155; CGR/DC-14/79; GC-D-49-79) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Search and Rescue Simulation (SARSIM) is a management tool that has been developed to aid Coast Guard decision-makers in developing long-range strategic plans to carry out the SAR mission. SARSIM is a discrete event digital computer simulation program programmed in SIMSCRIPT II.5. It is a highly flexible user-oriented model that simulates Coast Guard response to futuristic caseloads. SARSIM is comprised of three major modules. The first major module is the PREPROCESSOR. The PREPROCESSOR is used to generate expected caseloads based on the historical SAR Data Base. In other words, it supplies a scenario, or futuristic caseload which may, if desired, be used for many different simulation runs. The heart of SARSIM, the SIMULATOR, is essentially a bookkeeping system which logs in cases, registers their needs, investigates the availability of service facilities, assigns resources for servicing, and generally keeps track of simulated time spent in the several possible activities represented within the model and maintains statistics for output. The POSTPROCESSOR is a data retrieval package, which operates on data files from the SIMULATOR to permit a more detailed analysis of simulation runs as a supplement to the printed report from the SIMULATOR. GRA

N80-12079# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PROPULSION AND ENERGETICS PANEL WORKING GROUP 2 ON AIRCRAFT FIRE SAFETY. VOLUME 1: EXECUTIVE SUMMARY
B. P. Botteri (AFSC) Sep. 1979 17 p
(AGARD-AR-132-Vol-1; ISBN-92-835-0246-9) Avail: NTIS HC A02/MF A01

The fire experience, areas in which fire protection enhancement is needed, technological advances in the areas of safety and personnel survivability for a civilian turbine engine transport aircraft are presented. M.M.M.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-12080# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DABS SINGLE SENSOR PERFORMANCE TEST PLAN
Jul. 1979 157 p
(AD-A072695; FAA-NA-79-151) Avail: NTIS HC A04/MF A01 CSCL 17/7

The single-sensor performance tests are described which are to be conducted upon three engineering laboratory models of the Discrete Address Beacon System (DABS) sensor. These sensors are to be installed at NAFEC and two adjacent sites: Elwood and Clementon, New Jersey. These performance tests address the following characteristics: surveillance processing, accuracy and resolution, data link, performance monitoring and failure recovery, network management (stand-alone mode) and communications. The results of these performance tests will be used to prepare a technical data package for DABS procurement. F.O.S.

N80-12081# Electronics Research Lab., Adelaide (Australia).
THE FREQUENCY RESPONSE OF A PARTICULAR GIMBAL SYSTEM TO COHERENT ROTATION AND ACCELERATION EXCITATION
R. F. Dancer Dec. 1978 65 p refs
(AD-A073153; ERL-0037-TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

The general theoretical expression for the frequency response of a gimbal system to a joint rotation/acceleration driving force is derived. Theoretical estimates of physical system parameters are made for particular gimbal system. Experimental verification of these theories is obtained by measurements of the rotationally excited response of the gimbal system. GRA

N80-12082# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT, VOLUME 1
G. C. Howell, ed. (Royal Aircraft Establishment) Sep. 1979 43 p refs 2 Vol.
(AGARD-AR-147-Vol-1; ISBN-92-835-1339-8) Avail: NTIS HC A03/MF A01

Contents: (1) to study the application of GPS to interdiction, ground attack, interception and close combat aircraft; (2) to determine the extent which improved performance or new capabilities are made possible; (3) to study the integration of GPS into guidance and control systems, determine the impact on system design, and indicate where simplification and cost savings may be brought about; and (4) to make recommendations for further and more detailed study of the most promising applications. M.M.M.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-12083 Kansas Univ., Lawrence.
THE DEVELOPMENT OF THE DAST 1 REMOTELY PILOTED RESEARCH VEHICLE FOR FLIGHT TESTING AN ACTIVE FLUTTER SUPPRESSION CONTROL SYSTEM Ph.D. Thesis
David Lee Grose 1979 368 p
Avail: Univ. Microfilms Order No. 7925873

The development of the DAST 1 remotely piloted research vehicle is described. The DAST 1 is a highly modified BQM-34E/F Firebee 2 supersonic aerial target incorporating a swept supercritical wing designed to flutter within the vehicle's flight envelope. The predicted flutter and rigid body characteristics are presented. A description of the analysis and design of an active flutter suppression control system designed to increase the flutter boundary of the DAST wing by a factor of 20% is given. The design and development of the digital remotely augmented primary flight control system and onboard analog backup control system is presented. An evaluation of the near real time flight flutter testing methods is made by comparing results of five flutter testing techniques on simulated DAST 1 flutter data.
Dissert. Abstr.

N80-12084*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BEHAVIOR OF AIRCRAFT ANTISKID BRAKING SYSTEMS ON DRY AND WET RUNWAY SURFACES. A SLIP-VELOCITY-CONTROLLED, PRESSURE-BIAS-MODULATED SYSTEM
Sandy M. Stubbs, John A. Tanner, and Eunice G. Smith Washington Dec. 1979 194 p refs
(NASA-TP-1051; L-11760) Avail: NTIS HC A09/MF A01 CSCL 01C

The braking and cornering response of a slip velocity controlled, pressure bias modulated aircraft antiskid braking system is investigated. The investigation, conducted on dry and wet runway surfaces, utilized one main gear wheel, brake, and tire assembly of a McDonnell Douglas DC 9 series 10 airplane. The landing gear strut was replaced by a dynamometer. The parameters, which were varied, included the carriage speed, tire loading, yaw angle, tire tread condition, brake system operating pressure, and runway wetness conditions. The effects of each of these parameters on the behavior of the skid control system is presented. Comparisons between data obtained with the skid control system and data obtained from single cycle braking tests without antiskid protection are examined. A.W.H.

N80-12085# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
PREDICTION OF DRAG COEFFICIENTS OF A SUPERSONIC

V/STOL CONFIGURATION WITH VARIOUS STORE ARRANGEMENTS
Tsze C. Tai, Thomas H. Boyd, and Richard E. Kuhn Aug. 1979 43 p refs Presented at the Navy Symp. on Aerobalistics, NADC, Trevose, Penn., 22-24 Aug. 1978
(WR0230201)
(AD-A072999; DTNSRDC-79/074; DTNSRDC/AERO-1260) Avail: NTIS HC A03/MF A01 CSCL 20/4

Numerical computations, using supersonic area rule, linear theory and turbulent boundary layer solutions, were performed to evaluate the drag coefficients of a supersonic V/STOL configuration with various store arrangements. External stores included short- and medium-range missiles, electronic pod, and 600 gallon (2280 liters) fuel tanks. Predictions were based on cruise conditions at Mach numbers 1.2, 1.6, and 1.8 with Reynolds numbers between 2 and 66.2 million per foot. As expected, it was found that the drag coefficient decreases as the free-stream Mach number increases. The wave drag varies nonlinearly with added store capacity. Data indicate that for the same store capacity, the wave drag may be minimized by judicious selection of store location. GRA

N80-12086# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE PERFORMANCE OF A CONCEPTUAL VERTICAL ATTITUDE TAKEOFF AND LANDING FIGHTER AIRCRAFT Final Report, Sep. - Dec. 1978
Basil S. Papadales, Jr. Jan. 1979 30 p refs
(AD-A073100; DTNSRDC/ASED-76/06) Avail: NTIS HC A03/MF A01 CSCL 01/3

The performance of a conceptual 18,000 lb (8200 kg) vertical attitude takeoff and landing fighter aircraft is presented. The single-seat aircraft is designed around a single F100 turbofan. Contemporary avionics and materials technologies are assumed. The design payload includes an M61 cannon with ammunition and four Dogfight missiles. No compromises for mission capabilities, other than air combat, exist in the design. The fighter has a combat radius of 308 nm (570 km) with a maximum level speed in excess of Mach 2 at altitude. Range, turning, and specific excess energy performance are presented. Weight and range performance penalties for the inclusion of conventional landing gear, a rotating cockpit, and a multi-engine design are summarized. GRA

N80-12087# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
INERTIA CALCULATION PROCEDURE FOR PRELIMINARY DESIGN Final Report
Charles Lanham Apr. 1979 70 p refs
(AD-A072679; ASD-TR-79-5004) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report explains the methods involved in estimating aircraft moments of inertia for preliminary design purposes. Assumptions that were made for this procedure and the derviation of equations that evolved from these assumptions are included. An example using the method on the C-5A aircraft is shown. This procedure requires a knowledge of the major aircraft group weights, the location of major components (landing gear, avionics bay, etc.), geometry information, and inertias of some major subsystem items. Using this data, the moments of inertia about the roll, pitch, and yaw axes are calculated as well as the roll-yaw cross-product of inertia. GRA

N80-12088# Army Aviation Test Activity, Edwards AFB, Calif.
AH-1G LATERAL FLIGHT PERFORMANCE TEST
Leslie J. Hepler, James S. Kishi, and Albert L. Winn 30 Jun. 1979 21 p refs
(AD-A072868; USAASTA-71-43) Avail: NTIS HC A02/MF A01 CSCL 01/1

The lateral flight performance of the tractor-tail-rotor-configured AH-1G helicopter was evaluated at gross weights of 8500 and 9500 pounds. The AH-1G is capable of 0.53 g and 0.38 g accelerations in right and left lateral flight, respectively, at 8500 pounds. At a 9500 pound gross weight, acceleration was 0.23 g to the right and 0.20 g to the left. Aircraft handling qualities and time required to attain maximum lateral velocity are dependent upon rate and type of control application. A step-type lateral control input permitted rapid attainment of accelerating attitude but produced yaw oscillations which resulted in loss of directional control and caused high pilot workload in stabilizing power and aircraft attitude. Ramp inputs delayed establishment of the accelerating attitude. A modified pulse input induced negligible roll and yaw oscillation and produced rapid establishment of the desired roll attitude. Direction-of-flight reversals induced large power transients that frequently exceeded the transmission torque limits. Precise heading and pitch attitude could not be maintained during the reversals. Airspeed in lateral flight could not be determined without special airspeed measuring devices. The sideward airspeed limit was exceeded frequently in left lateral flight with no warning or cue to the pilot that the limit had been reached. GRA

N80-12089# Battelle Columbus Labs., Ohio.
F-111 A/E DIGITAL BOMB-NAV SYSTEM SOFTWARE ANALYSIS Final Technical Report, Apr. - Nov. 1978
Ellis Hitt, Tom Clark, Mike Bridgman, Bill Young, and Norman Thompson Wright-Patterson AFB, Ohio AFAL Apr. 1979 331 p refs
(Contract F33615-76-C-1299; AF Proj. 2003)
(AD-A072826; AFAL-TR-79-1043) Avail: NTIS HC A15/MF A01 CSCL 09/2

The objective of this project was to perform an independent evaluation of the technical and economic factors affecting a set of software development alternatives for the F-111A and F-111E digital bomb-navigation system operational flight program. Specifically, the use of Jovial (J73/I), higher order language or the assembly language of the selected computer was compared. The comparison was to consider the implications of various software development options as well as the impact of the options on the existing software support organizations and facility at Sacramento, Cal. GRA

N80-12001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
A SURVEY OF AEROELASTIC PROBLEMS
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 p 1-15 refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
AEROELASTICITY FROM THE VIEWPOINT OF THE DESIGNER
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 32 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
MODAL ANALYSIS OF AIRCRAFT STRUCTURES
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 26 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
LIFTING SURFACE DIVERGENCE AND CONTROL EFFECTIVENESS
H. Foersching *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 35 p (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12005# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
MODAL REPRESENTATION AND TRANSFER FUNCTION OF LINEAR DISSIPATIVE STRUCTURES
Roland Dat *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 20 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12004# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
NEW METHODS FOR GROUND TESTS OF AERONAUTICAL STRUCTURES
G. Piazzoli In Von Karman Inst. for Fluid Dyn. , Aeroelastic Problems in Aircraft Design 1979 22 p refs In FRENCH; ENGLISH summary (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation and 35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.*

N80-12090*# Massachusetts Inst. of Tech., Cambridge.
PREMIXING QUALITY AND FLAME STABILITY: A THEORETICAL AND EXPERIMENTAL STUDY Final Report
Krishnan Radhakrishnan, John B. Heywood, and Rodney J. Tabaczynski Washington Dec. 1979 65 p refs
(Grant NGR-22-009-378)
(NASA-CR-3216) Avail: NTIS HC A04/MF A01 CSCL 21E

Models for predicting flame ignition and blowout in a combustor primary zone are presented. A correlation for the blowoff velocity of premixed turbulent flames is developed using the basic quantities of turbulent flow, and the laminar flame speed. A statistical model employing a Monte Carlo calculation procedure is developed to account for nonuniformities in a combustor primary zone. An overall kinetic rate equation is used to describe the fuel oxidation process. The model is used to predict the lean ignition and blow out limits of premixed turbulent flames; the effects of mixture nonuniformity on the lean ignition limit are explored using an assumed distribution of fuel-air ratios. Data on the effects of variations in inlet temperature, reference velocity and mixture uniformity on the lean ignition and blowout limits of gaseous propane-air flames are presented. A.W.H.

N80-12091*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
DESIGN, DURABILITY AND LOW COST PROCESSING TECHNOLOGY FOR COMPOSITE FAN EXIT GUIDE VANES
S. S. Blecherman Aug. 1979 139 p refs
(Contract NAS3-21037)
(NASA-CR-159677; PWA-5570-37) Avail: NTIS HC A07/MF A01 CSCL 21E

A lightweight composite fan exit guide vane for high bypass ratio gas turbine engine application was investigated. Eight candidate material/design combinations were evaluated by NASTRAN finite element analyses. A total of four combinations were selected for further analytical evaluation, part fabrication by two vendors, and fatigue test in dry and wet condition. A core and shell vane design was chosen in which the unidirectional graphite core fiber was the same for all candidates. The shell material, fiber orientation, and ply configuration were varied. Material tests were performed on raw material and composite specimens to establish specification requirements. Pre-test and post-test microstructural examination and nondestructive analyses were conducted to determine the effect of material variations on fatigue durability and failure mode. Relevant data were acquired with respect to design analysis, materials properties, inspection standards, improved durability, weight benefits, and part price of the composite fan exit guide vane. R.C.T.

N80-12092*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ENGINE COMPONENT IMPROVEMENT PROGRAM: PERFORMANCE IMPROVEMENT
John E. McAulay 1979 17 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79304; E-256) Avail: NTIS HC A02/MF A01 CSCL 21E

Fuel consumption of commercial aircraft is considered. Fuel saving and retention components for new production and retrofit of JT9D, JT8D, and CF6 engines are reviewed. The manner in which the performance improvement concepts were selected for development and a summary of the current status of each of the 16 selected concepts are discussed. R.C.T.

N80-12093# General Dynamics Corp. Fort Worth, Tex. Fort Worth Div.
THE CRITICALITY OF ENGINE EXHAUST SIMULATIONS ON VSTOL MODEL-MEASURED GROUND EFFECTS Final Report, Jul. 1978 - Aug. 1979
J. R. Lummus Jul. 1979 213 p refs
(Contract N00014-78-C-0384)
(AD-A073114; ONR-CR-212-255-1F) Avail: NTIS HC A10/MF A01 CSCL 20/4

This experimental investigation demonstrated the criticality of performing accurate full-scale engine exhaust simulations during model-measured VSTOL ground effects testing. The effects of varying the nozzle exit turbulence, total pressure distributions, and nozzle pressure ratio on the net and component ground-induced forces for two-, three-, and four-nozzle configurations with large blocking surfaces (as well as a smaller, cruciform two-nozzle blocking surface more characteristic of a real aircraft planform) were studied. GRA

N80-12094# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
VALIDATION OF THE DETROIT DIESEL ALLISON LOGISTIC SUPPORT COST MODEL (PROGRAM OS 590) M.S. Thesis
Howard E. Creek and Christopher Harlambakis Jun. 1979 83 p refs
(AD-A072670; AFIT-LSSR-20-79A) Avail: NTIS HC A05/MF A01 CSCL 21/5

The Department of Defense (DoD) is genuinely concerned about Operation and Support Costs (O/S) during the early stages of the aquisition process. An area of particular interest to the Air Force Aero Propulsion laboratory (AFAPL) was the validation of Detroit Diesel Allison's O/S cost model, OS590. This study was designed to assist the AFAPL in determining O/S costs for future advanced high technology turbine engines. The results of this research include the following findings: (a) input data for OS590 within the scope of this effort was available from Air Force sources; (b) OS590 produced valid O/S costs; (c) OS590 was sensitive to selected input parameters; and (d) the Directorate of Propulsion YZLR reviewed and agreed that OS590 was complete. GRA

N80-12095# Dayton Univ. Research Inst., Ohio.
IMPACT DAMAGE ON TITANIUM LEADING EDGES FROM SMALL SOFT BODY OBJECTS Interim Report, Apr. 1976 - Aug. 1977
Robert S. Bertke and John P. Barber Mar. 1979 66 p refs
(Contract F33615-76-C-5124; AF Proj. 2307)
(AD-A072705; UDR-TR-78-54; AFML-TR-79-4019) Avail: NTIS HC A04/MF A01 CSCL 21/5

Impact damage on titanium leading edge configurations was investigated by performing leading edge soft-body impacts on flat-edge and tapered-edge specimens. The objectives were to determine the laboratory specimen size, boundary condition, and test methods necessary to adequately simulate the leading edge

local damage of actual blades from soft-body impacts (such as birds). The effects of leading edge geometry, specimen mounting, impact velocity, impactor type, impactor size, and impact angle were investigated. The damage modes excited in titanium were identified. Damage measurement techniques were devised and the damage quantified. Comparisons of the damage were drawn regarding the effects of specimen size and mounting. GRA

N80-12096# Scientific Research Associates, Inc., Glastonbury, Conn.
COMPUTATION OF DISCRETE HOLE FILM COOLING FLOW USING THE NAVIER-STOKES EQUATIONS
J. P. Kreskovsky, W. R. Briley, and H. McDonald Jul. 1979 17 p refs
(Contract F49620-78-C-0038)
(AD-A073057; R79-910002-1; AFOSR-79-0935TR) Avail: NTIS HC A02/MF A01 CSCL 21/5

An investigation is being performed to develop an analysis and computational procedure for predicting the flow field which results from discrete hole film cooling. This study represents the first step in the development of a computer code capable of predicting aerodynamic loss levels and heat transfer levels associated with discrete hole film cooling on gas turbine blades. The specific problem tleing considered here is that of predicting the flow and temperature fields resulting from injecting a row of hot or cold jets into a cross flow through a flat plate. The approach is based on numerical solution of the three-dimensional compressible Navier-Stokes equations, and utilizes a zone embedding procedure to limit the computational domain to the immediate vicinity of the coolant injection. The zone embedding is accomplished through the use of interactive boundary conditions at inflow and outflow boundaries, which are compatible with flow behavior outside the computational region. GRA

N80-12097# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
***SUPERSONIC COMBUSTION, AIR DISSOCIATION THROUGH SHOCK WAVES AND AERODYNAMICS OF CHEMICALLY REACTING GASES IN A PLANAR CONVERGING - DIVERGING NOZZLES* Final Report, Mar. - Oct. 1978. M.S. Thesis - Ohio State Univ., Columbus**
Dennis W. Schroll May 1979 72 p refs
(AD-A073135; ASD-TR-79-5002) Avail: NTIS HC A04/MF A01 CSCL 21/5

Much research has been accomplished to develop a supersonic ramjet engine. Very little headway has been made in theoretical design techniques as many of the standard computational methods used for ramjet subsonic combustion do not apply. For instance, it is possible to use a constant area nozzle for subsonic combustion in a ramjet as heat addition and frictional effects in the combustion chamber will decrease the pressure and accelerate the flow. For supersonic combustion the velocity decreases tending to choke the flow. To overcome this area increase in the combustion zone is used. A strong normal shock on the diffuser inlet for free stream mach numbers of 5 and 10 and the shock free flow of these mach numbers are assumed. Accompanied with the strong normal shock are large stagnation pressure losses in the diffuser inlet, meaning the diffuser inlet will act as a flat plate to oncoming airflow. For this reason, it would be best to provide air spillage and not use too large an inlet. The final Thrust Specific Fuel Consumption values are sufficiently high to warrant further investigation into supersonic combustion as a method of propulsion. GRA

N80-12024# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS AND MODELLING OF THE FLOW WITHIN A TURBOMACHINE COMBUSTOR
Patrick Hebrard, Philippe Magre, and Gerard Collin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 33-54 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 233-249
Original language report was announced as A79-18533 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-12098 Michigan Univ., Ann Arbor.
COMPUTER AIDED DESIGN OF SUBOPTIMAL CONSTANT GAIN FILTERS SUBJECT TO STABILITY CONSTRAINTS Ph.D. Thesis
Spyridon P. Karatsinides 1979 140 p
Avail: Univ. Microfilms Order No. 7925172

An algorithm for the design of an alternate filter that has the Kalman structure and at the same time satisfies predefined stability bounds is developed. In addition to satisfying the stability requirements the filter also produces the best possible estimate of the state. The algorithm proceeds in two stages. In the first stage, the eigenvalues of the filter stability matrix are moved inside the appropriate restricted region. In the second stage, the trace of the error covariance matrix is minimized inside the specified region. The error covariance matrix is determined by the solution of an algebraic matrix Lyapunov equation. The quality principle between the control and state estimation problems proves to exist for the suboptimal cases. This allows the use of the algorithm for the design of suboptimal regulators under stability constraints. The algorithm is applied to numerous example problems, including the combined control state estimation problem for the attitude control of a solar probe. Dissert. Abstr.

N80-12099# Aeronautical Research Labs., Melbourne (Australia).
SEA KING Mk. 50 HELICOPTER FLIGHT CONTROL SYSTEM. A MATHEMATICAL MODEL OF THE AFCS (AUTOSTABILIZER/AUTOPILOT MODE)
C. R. Guy Feb. 1979 24 p refs
(ARL/Aero-Note-387; AR-001-805) Avail: NTIS HC A02/MF A01

A mathematical model for the autostabilizer/autopilot mode of the automatic flight control system (AFCS) for the Sea King Mk.50 helicopter is presented. An outline of the autostabilizer/autopilot used in the aircraft is given followed by a description of the mathematical model, which includes a representation of each major element of the aircraft system. R.C.T.

N80-12100*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL FLIGHT SIMULATION
Nov. 1979 52 p refs
(NASA-TM-81156; A-8012) Avail: NTIS HC A04/MF A01 CSCL 01C

The requirements for a new research aircraft to provide in-flight V/STOL simulation were reviewed. The required capabilities were based on known limitations of ground based simulation and past/current experience with V/STOL inflight simulation. Results indicate that V/STOL inflight simulation capability is needed to aid in the design and development of high performance V/STOL aircraft. Although a new research V/STOL aircraft is preferred, an interim solution can be provided by use of the X-22A, the CH-47B, or the 4AV-8B aircraft modified for control/display flight research. R.C.T.

N80-12007# Avions Marcel Dassault, Saint-Cloud (France).
PRACTICAL ASPECTS OF THE CALCULATION OF STRUCTURAL VIBRATIONS
J. P. Brevan *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 60 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12010# Liege Univ. (Belgium).
AIRCRAFT FLUTTER AND DYNAMIC RESPONSE
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Aeroelastic Problems in Aircraft Design 1979 58 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12011# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

WIND TUNNEL FLUTTER INVESTIGATIONS
O. Sensburg *In* Von Karman Inst. for Fluid Dyn. Aeroelastic *Problems in Aircraft Design* 1979 59 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

N80-12012# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
FLIGHT FLUTTER TESTING
G. Haidl and M. Steininger *In* Von Karman Inst. for Fluid Dyn. *Aeroelastic Problems in Aircraft Design* 1979 41 p refs (For primary document see N80-12000 03-01)
Avail: NTIS HC A23/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-12101# European Space Agency, Paris (France).
CONSTRUCTION PROBLEMS FOR HIGH REYNOLDS NUMBER WIND TUNNEL MODELS
Maurice Bazin Jun. 1979 50 p refs Transl. into ENGLISH of 'Problems de Construction de Maquettes pour les Soufflerles a Grand Nombre de Reynolds', ONERA, Paris Report ONERA-NT-1978-6, 1978 Presented at 14th Colloq. d'Aerodyn. Appl. de l'Assoc. Aeron. et Astron. de France, Toulouse, 7-9 Nov. 1977 Original report in FRENCH previously announced as N79-32224
(ESA-TT-564; ONERA-NT-1978-6) Avail: NTIS HC A03/MF A01

Design structures, problems of definition, and materials for high Reynolds number wind tunnel models are discussed. Models for force and pressure distributions, air intakes, jet simulation, and dynamic flutter are considered. It is shown that deformations in operation under the effect of aerodynamic and thermal loads require new measuring techniques and the adaptation of the capacity, thermal protection, and calibration methods of the balance. The mechanical strength of the supports, in particular the risk of divergence, and the dynamic behavior of the mountings are the most severe limitations in the use of pressurized wind tunnels. Thermal problems are added in a cryogenic environment. The development of pressure measurement methods and instruments is considered. Author (ESA)

N80-12102# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DETERMINATION IN GROUND FACILITIES OF AERODYNAMIC STABILITY PARAMETERS OF AIRCRAFT
M. Scherer Sep. 1979 69 p refs In FRENCH; ENGLISH summary
(AGARD-AG-242; ISBN-92-835-2106-4) Avail: NTIS HC A04/MF A01

The present state of experimental ground facilities for determining the aerodynamic stability parameters of aircraft was deduced from the proceedings of the AGARD/FDP and FMP meetings of the last four years. A critical study of the experimental methods for analyzing unsteady aerodynamic phenomena brings to light the insufficiencies of present-day methods and means, especially as regards information necessary for the correct implementation of flight simulators in case of non-linear behavior (separation, shock wave). Suggestions are presented on the possible orientations of research for filling these gaps. Author

N80-12019# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRELIMINARY TESTS IN A CRYOGENIC WIND TUNNEL DRIVEN BY INDUCTION
Roger Michel and Dietrich Faulmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 145-152 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 205-207 Presented at Supersonic Tunnel Assoc. Meeting, El Segundo, Calif., 17-18 Apr. 1978 Original language report was announced as A79-15300 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-12103*# Analytical and Computational Mathematics, Inc., Houston, Tex.
ORBIT DECAY ANALYSIS OF STS UPPER STAGE BOOSTERS Final Report
O. F. Graf, Jr. and Alan C. Mueller [1979] 64 p refs
(Contract NAS9-15444)
(NASA-CR-160385; ACM-TR-119) Avail: NTIS HC A04/MF A01 CSCL 22A

An orbit decay analysis of the space transportation system upper stage boosters is presented. An overview of the computer trajectory programs, DSTROB, algorithm is presented. Atmospheric drag and perturbation models are described. The development of launch windows, such that the transfer orbit will decay within two years, is discussed. A study of the lifetimes of geosynchronous transfer orbits is presented. A.W.H.

N80-12104# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN INTERMEDIATE-AVERAGED THEORY FOR HIGH ALTITUDE ORBITS
Ramaswamy Sridharan and William P. Seniw 27 Jun. 1979 20 p refs
(Contract F19628-78-C-0002)
(AD-A073094; TN-1979-25; ESD-TR-79-164) Avail: NTIS HC A02/MF A01 CSCL 22/3

An analytic theory for the evolution of high altitude satellite orbits is developed in this note. The distinctive feature of the theory lies in the double averaging of the differential equations - once over the period of the orbit, and secondly over the period of the moon. This technique is called intermediate averaging to distinguish it from the conventional doubly averaged theories, and to denote the time scales inherent in the averaging technique. GRA

N80-12105# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
WAKE STUDIES RELATED TO REENTRANT PYRAMIDS Final Report, 1 Jan. 1976 - 30 Nov. 1978
Marshall Solomon, Morton Finston, and Charles W. Haldeman Aug. 1979 82 p refs
(Contract F44620-76-C-0049)
(AD-A073825; MIT-TR-205; AFOSR-79-0984TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The original objectives of this project were to completely map the reentrant pyramid near wake with pitot pressure and recovery temperature probes in order to study the axial development of the wake's azimuthal asymmetry. Although only a modest amount of data has been collected, compared to our original goal, sufficient information is available to identify most features of the pyramid's wake and to make a comparison to the axisymmetric cone wake. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also 09 Research Support Facilities (Air).

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-12106*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 4: SPS POINT DESIGN DEFINITION Final Report
G. Hanley Apr. 1978 220 p 5 Vol.
(Contract NAS8-32475)
(NASA-CR-150683; SD-78-AP-0023-4-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 22B

The satellite power systems point design concept is described. The concept definition includes satellite, ground and space systems, and their relationships. Emphasis is placed on the definition of the GaAlAs photovoltaic satellite system. The major subsystems of the satellite system including power conversion, power distribution and control, microwave, attitude control and stationkeeping, thermal control, structures, and information management and control are discussed. A.W.H.

N80-12107*# Battelle Columbus Labs., Ohio.
IGOS IMPROVEMENTS FOR SEASAT Final Report
Janice M. Warmke Apr. 1979 110 p
(Contract NASw-2800)
(NASA-CR-162604; BCL-OA-TPR-79-2) Avail: NTIS HC A06/MF A01 CSCL 22B

Modifications to Battelle's Interactive Graphics Orbit Selection (IGOS) computer program to assist in the planning and evaluation of the Seasat-A Scatterometer System (SASS) flight program were studied. To meet the planning needs of the LaRC Seasat-A Scatterometer team, the following features/modifications were implemented in IGOS: (1) display and specification of time increments in orbital passes represented by the cross-hatching of ground swaths; (2) addition of pass number annotations on the horizontal axis of the STPLNG and STPTOD plots; (3) modification of the sensor model to include more than two swaths associated with a single sensor to approximate the SASS cell pattern; (4) inclusion of down range and cross-track swath geometry to display the characteristic skewed SASS pattern; (5) addition of a swath schedule to allow the display of the SASS mode changes and to calibrate gaps; and (6) development of a set of commands to generate the detailed swath data from sensor characteristics and orbit/earth motion. F.O.S.

N80-12108*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY. PART 1: MIDTERM BRIEFING Interim Report
19 Oct. 1978 456 p
(Contract NAS9-15636)
(NASA-CR-160369; D180-24872-1; DRL-T-1487; DRD-MA-732T) Avail: NTIS HC A20/MF A01 CSCL 22B

The solar power satellite systems are defined and analyzed. Included are areas of space construction, rectennal construction, rectenna siting, and the aluminum satellite structure. A.W.H.

N80-12109*# Boeing Aerospace Co., Seattle, Wash. Ballistic Missiles and Space Div.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, VOLUME 5, PHASE 2: FINAL BRIEFING Final Report
5 Nov. 1979 640 p
(Contract NAS9-15636)
(NASA-CR-160380; D180-25461-5-Vol-5; DRL-T-1487; DRD-MA-732T) Avail: NTIS HC A99/MF A01 CSCL 22B

A briefing outline of the definition study is presented. Topics discussed include: Solar Power Satellite (SPS) research and development, definition study, operations control, transportation, solid state SPS, pilot link analysis, and offshore space center. F.O.S.

N80-12110# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
A SHOCK TUBE INVESTIGATION OF SILO-LAUNCHED VEHICLE AERODYNAMIC FLOW ASYMMETRIES Interim Report
Robert L. Varwig, David H. Ross, and J. M. Lyons 5 Jul. 1979 59 p
(Contract F04701-78-C-0079)
(AD-A071811; TR-0079(4550-83)-1; SAMSO-TR-79-48) Avail: NTIS HC A04/MF A01 CSCL 16/1

A shock tube was used to simulate the initial transient flow from a rocket launching silo when the rocket motor was ignited. The object was to investigate the relationship between lateral loads observed on the missile being launched during the early transient flow and the silo exit geometry. A centerbody simulating the missile to be launched was installed in the shock tube and instrumented with pressure gages to detect the lateral loads. Three silo exit geometries were also modeled. The early transient flow in the silo is described along with the modeling of this flow by the shock tube. Finally, the pressures measured on the missile model are presented together with a correlation technique that was developed to display the effect of the silo exit geometries on the model pressure difference force. Also included are results from the application of this correlation technique to full-scale flight data, which appear to demonstrate a close relationship between on-board accelerometer measurements and the pressure difference force history. GRA

N80-12111# Systems Research Labs., Inc., Dayton, Ohio. Aerosystems Research Div.
PRELIMINARY DESIGN AERODYNAMIC PREDICTION METHODOLOGY FOR MISSILES WITH NOSE BLUNTNESS Final Report, Apr. 1977 - Jun. 1978
Charles W. Ingram, Karlheinz O. W. Ball, Carter Dinkeloo, and David Shida Wright-Patterson AFB, Ohio AFFDL Sep. 1978 199 p refs
(Contract F33615-75-D-0089; AF Proj. 2403)
(AD-A073664; AFFDL-TR-78-117) Avail: NTIS HC A09/MF A01 CSCL 20/4

A semi-empirical methodology is presented for predicting the axial and normal force coefficients and the center of pressure to include nose bluntness effects for missiles. This methodology includes the transonic and supersonic Mach number regime with angles of attack from 0 to 180 degrees. This methodology correlates well with wind tunnel test data. GRA

N80-12112# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
THE ATS6 RADIO BEACON POINTING DATA: OCTOBER 1975 - JANUARY 1976 Technical Memorandum
R. F. Donnelly, R. Hetzel, and J. Falcon Mar. 1979 98 p
(PB-297511/8; NOAA-TM-ERL-SEL-53; NOAA-79061312) Avail: NTIS HC A05/MF A01 CSCL 22C

Pointing data for the ATS6 satellite are presented for use by radio-beacon experimenters to determine and correct the errors introduced in their measurements by small changes in the direction of the satellite. These errors are important for midlatitude measurements of plasmaspheric content and for equatorial measurements of the shape-factor F. GRA

N80-12023# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESTITUTION OF MISSILE TRAJECTORIES BY KALMAN FILTERING-SMOOTHING

Dominique Biausse *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 13-31 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 221-232 Original language report was announced as A79-18532 Sponsored by DRET (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A SYNTHESIS OF THE EXPERIENCE ACQUIRED BY ONERA ON THE POGO PHENOMENON
Daniel Lourme, Jean-Jacques Dordain, and Denis Schmitt *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 45-67 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 321-334 Original language report was announced as A77-51427 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-12033# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYNTHESIS OF FLIGHT RESULTS OF THE CACTUS ACCELEROMETER FOR ACCELERATIONS BELOW ONE BILLIONTH G
Yves Boudon (Centre of Geodyn. and Astron. Res., Grasse, France), Francois Barlier, Alain Bernard, Remy Juillerat, Anne-Marie Mainguy, and Jean-Jacques Walch (Centre of Geodyn. and Astrodyn. Res., Grasse, France) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 67-76 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 355-364 Presented at 29th Intern. Astronautical Congr., Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11247 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

N80-12034# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD
Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-353 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279 (For primary document see N80-12029 03-01)
Avail: NTIS HC A06/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-12113# Tennessee Univ. Space Inst., Tullahoma.
REFINEMENT OF PLUME MODELING IN THE INFRARED SPECTRAL REGION Final Report, 19 Nov. 1976 - 30 Jun. 1978
Kenneth E. Harwell 30 Jun. 1979 103 p refs
(Contract DAAK40-77-C-0032)
(AD-A072725) Avail: NTIS HC A06/MF A01 CSCL 21/8

The MIRADCOM Radiation Model was improved and used successfully to predict CO2 and H2O radiation emitted from a turbojet exhaust plume and a rocket exhaust plume. The model was validated using experimental data. Two existing gas dynamic models (LAPP and REPS) were employed to calculate the flow field properties required as input to the radiation computer codes. A new finite difference code was developed, but was only partially successful in predicting imbedded shock waves. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-12114 Kansas Univ., Lawrence.
ION ELECTRODES SELECTIVE FOR ORGANIC FUNCTIONAL GROUPS Ph.D. Thesis
Steven Hamilton Hoke 1979 86 p
Avail: Univ. Microfilms Order No. 7925821

Research conducted on ion selective electrodes for both the carbonyl and sulfonate functional groups is discussed. The carbonyl electrode consisted of a polyvinyl chloride membrane containing 3 amino bis phthalate. This electrode was expected to exhibit a potential across the membrane via the charged intermediate formed in the Schiff's Base reaction between the primary amine and a carbonyl. Infrared indicated the free primary amine in the membrane. An electrical potential across the membrane was produced by protonating the amine. Several solid electrodes are also investigated. Dissert. Abstr.

N80-12115 Lehigh Univ., Bethlehem, Pa.
PREPARATION AND CHARACTERIZATION OF LATEXES Ph.D. Thesis
Syed Mahmood Ahmed 1979 164 p
Avail: Univ. Microfilms Order No. 7919966

A serum replacement technique was developed for cleaning latexes for characterization. Distilled, deionized water is pumped through the latex while the particles are confined in a stirred flow-through cell by a Nucleopore filtration membrane. This washing with water removes the solute electrolyte and adsorbed emulsifier and water-soluble polymers, but does not completely replace the Na(+) and K(+) counterions with H(+) ions. Further washing with dilute hydrochloric acid followed by a water wash to remove excess acid replaces these counterions completely. This method of cleaning gives results in much better agreement with results using the ion exchange method than the results using the dialysis method, yet avoids arduous purification of the resins. Dissert. Abstr.

24 COMPOSITE MATERIALS

Includes laminates.

N80-12116 Michigan Univ., Ann Arbor.
RESOLUTION OF HEAT-CAPACITY CONTRIBUTIONS IN LANTHANIDE COMPOUNDS (THERMOPHYSICS OF THE LANTHANIDE TRIHYDROXIDES) Ph.D. Thesis
Robert Dennis Chirico 1979 252 p
Avail: Univ. Microfilms Order No. 7925122

Lattice heat capacities and Schottky contributions are resolved and analyzed for a series of lanthanide trihydroxides through heat-capacity measurements between 5 and 350 K. These compounds all crystallize with the UCl3-type structure and, therefore, are a particularly suitable series for which to attempt this separation. These two methods are described and discussed in detail and the derived energy levels are compared with spectroscopic data that do exist for the concentrated trichlorides. Dissert. Abstr.

N80-12117*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MULTIWALL THERMAL PROTECTION SYSTEM Patent Application
L. Robert Jackson, inventor (to NASA) Filed 5 Sep. 1979 19 p
(NASA-Case-LAR-12620-1; US-Patent-Appl-SN-072857) Avail: NTIS HC A02/MF A01 CSCL 11D

Multiwall insulating sandwich panels are provided for thermal protection of hypervelocity vehicles and other enclosures. In one version of the invention, the multiwall panels are formed of alternate layers of dimpled and flat metal (titanium alloy) foil sheets and beaded scarfed edge seals to provide enclosure thermal protection up to 1000 F. Another version employs an intermediate fibrous insulation for the sandwich panel to provide thermal protection up to 2000 F, and a third version employs a silicide coated columbium waffle as the outer panel skin and fibrous layered intermediate protection for thermal environment protection up to 2500 F. The use of multiple panels on an enclosure facilitates repair of the thermal protection system. NASA

N80-12118*# TRW Equipment Labs., Cleveland, Ohio.
SECOND GENERATION PMR POLYIMIDE/FIBER COMPOSITES
P. J. Cavano 26 Oct. 1979 144 p refs
(Contract NAS3-21349)
(NASA-CR-159666; ER-7989F) Avail: NTIS HC A07/MF A01 CSCL 11D

A second generation polymerization monomeric reactants (PMR) polyimdes matrix system (PMR 2) was characterized in both neat resin and composite form with two different graphite fiber reinforcements. Three different formulated molecular weight levels of laboratory prepared PMR 2 were examined, in addition to a purchased experimental fully formulated PMR 2 precurser solution. Isothermal aging of graphite fibers, neat resin samples and composite specimens in air at 316 C were investigated. Humidity exposures at 65 C and 97 percent relative humidity were conducted for both neat resin and composites for eight day periods. Anaerobic char of neat resin and fire testing of composites were conducted with PMR 15, PMR 2, and an epoxy system. Composites were fire tested on a burner rig developed for this program. Results indicate that neat PMR 2 resins exhibit excellent isothermal resistance and that PMR 2 composite properties appear to be influenced by the thermo-oxidative stability of the reinforcing fiber. R.C.T.

N80-12119*# Michigan Univ., Ann Arbor.
INCREASED FRACTURE TOUGHNESS OF GRAPHITE-EPOXY COMPOSITES THROUGH INTERMITTENT INTERLAMINAR BONDING Final Technical Report, Nov. 1978 - Oct. 1979
David K. Felbeck and Li-Chung Jea Oct. 1979 37 p refs
(Grant NGR-23-005-528)
Avail: NTIS HC A03/MF A01 CSCL 11D

Increased fracture toughness of multilayer continuous-filament graphite-epoxy composites was studied. The method used was intermittent interlaminar bonding, which leads to a large increase in the fracture surface area. Intermittent bonding was achieved through the introduction of thin perforated Mylar between the layers of the composite. Fracture toughness was increased from about 100 kJ square meters for untreated specimens to an average of about 500 kJ square meters. Tensile strength dropped from 500 MPa to 400 MPa, and elastic modulus remained the same at about 75 GPa. An approximate analysis is presented to explain the observed improvement in toughness. R.C.T.

N80-12120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTY CHARACTERIZATION OF INTRAPLY HYBRID COMPOSITES
C. C. Chamis, R. F. Lark, and J. H. Sinclair 1979 26 p refs Presented at the Am. Soc. for Testing and Materials Symp., Dearborn, Mich., 2-3 Oct. 1979
(NASA-TM-79306; E-261) Avail: NTIS HC A03/MF A01 CSCL 11D

An investigation was conducted to characterize the mechanical properties of intraply hybrids made from graphite fiber/epoxy matrix (primary composites) hybridized with varying amounts of secondary composites made from S-glass or Kevlar 49 fibers. The tests were conducted using thin laminates having the same thickness. The specimens for these tests were instrumented with strain gages to determine stress-strain behavior. Significant results are included. R.C.T.

N80-12121# Pennsylvania Univ., Philadelphia. Coll. of Engineering and Applied Science.
PROCESSING FUNDAMENTALS FOR INTERCALATION OF GRAPHITE FIBERS Technical Report, 15 Sep. 1977 - 15 Sep. 1979
F. Lincoln Vogel and William C. Forsman May 1979 54 p refs
(Contract F33615-77-C-5182; AF Proj. 2422)
(AD-A072943; AFML-TR-79-4034) Avail: NTIS HC A04/MF A01 CSCL 11/4

Chemical kinetics of intercalation of carbon/graphite fibers with HNO sub 3/AsF sub 5 was determined. Fiber electrical conductivity increased by about an order of magnitude. Humidity testing of the bare fiber caused deintercalation as expected but the intercalated fibers were successfully incorporated into epoxy matrix composites which maintained their properties with time at room temperature. The expected increase of IR reflectivity at 10.6 microns for the intercalated fiber composite was not obtained. The remarkable observation was made that the electrical conductivity of composites was increased by a factor of about one hundred when filled to 55% with intercalated fibers having a seven fold increase in conductivity. GRA

N80-12122# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
EFFECTS OF THERMAL SPIKING ON GRAPHITE-EPOXY COMPOSITES Interim Report, Mar. 1978 - Mar. 1979
George S. Springer and Alfred C. Loos Jun. 1979 69 p refs
(Contract F33615-75-C-5165; AF Proj. 7340)
(AD-A072825; AFML-TR-79-4059) Avail: NTIS HC A04/MF A01 CSCL 11/4

Tests were performed evaluating the effects of thermal spikes on the moisture absorption characteristics, the ultimate tensile strength, and the buckling modulus of Thornel 300/Fiberite 1034 composites. Measurements were made on unidirectional and angleply laminates, using different types of thermal spikes. A survey was also made of the existing data. This survey, together with the present data, indicate how thermal spikes affect the moisture absorption and the mechanical properties of different graphite-epoxy composites. GRA

N80-12123# Martin Marietta Aerospace, Orlando, Fla.
TEST AND EVALUATION OF GRAPHITE/EPOXY COMPOSITE STRUCTURE Final Report, 16 Nov. 1978 - 16 Mar. 1979
Robert P. Hewitt, Jr., Frank H. Koo, and Robert D. Keys (Denver Div.) Jul. 1979 128 p refs
(Contract DAAG46-79-C-0006; DA Proj 1W1-62113-A-661) (AD-A072770; OR-15448; AMMRC-TR-79-39) Avail: NTIS HC A07/MF A01 CSCL 11/4

The test and evaluation of a graphite/epoxy structure is part of a technology program to develop and validate composite structures for BMD interceptor applications. This contract is essentially an extension of work recently completed by Martin Marietta Corporation on Phase I of the Advanced Structures Prototype (ASP) program conducted for the Ballistic Missile Defense Advanced Technology Center (BMDATC) under Contract DASG60-77-C-0111. This report presents the results of the test and evaluation of six subscale conical frusta during the period from November 1979 through March 1979. The objective of this evaluation was to provide an increased structural data base for the assessment of the strength and stiffness properties of ultra-high modulus GY70/934 graphite/epoxy structure fabricated by the hand-laid gore, autoclave cure processes. The contractual effort was divided into three tasks: Task 1 - Fabrication of Conical Frusta; Task 2 - Static Testing of Frusta; Task 3 - Plan for Further Development. GRA

N80-12124# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF CONSTITUENT PROPERTIES ON COMPOSITE STRENGTH
H. Thomas Hahn 22 Dec. 1978 11 p refs Presented at the 24th Annual SAMPE Symp., San Francisco, 8-10 May 1979
(Contract W-7405-eng-48)
(UCRL-82051; Conf-790517-2) Avail: NTIS HC A02/MF A01

Several sets of data were examined concerning the effect of matrix properties on the strength of continuous and discontinuous fiber composites. The data are analyzed in terms of the average constituent stresses and the matrix ductility. The analysis correctly predicts the experimental observation that the composite-to-matrix strength ratio in transverse tension and shear can be greater than unity and can increase with the constituent modulus ratio and the fiber content. This observation is contrary to the elastic prediction which is applicable only if the composite failure is triggered by the premature interfacial failure. The use of a strong and ductile matrix may improve the fiber efficiency. DOE

N80-12125# European Space Agency, Paris (France). Research Div. for Materials and Construction Techniques.
ON THE PROBABILITY OF CRACK PROPAGATION IN A UNIDIRECTIONAL COMPOSITE WITH A SINGLE FIBER BREAKAGE Ph.D. Thesis - Stuttgart Univ.
Kuno Stellbrink Mar. 1979 104 p refs Transl. into ENGLISH of 'Ueber relative Bruchwahrsheinlichkeiten benachbarter Fasern in belasteten Composites', DFVLR, Stuttgart Report DLR-FB-77-56, Dec. 1977 Original German report available from DFVLR, Cologne DM 42.70
(ESA-TT-524; DLR-FB-77-56) Avail: NTIS HC A06/MF A01

Taking the case of a large, tension loaded, glass fiber reinforced plastic strand with unidirectional fiber orientation, calculations are made of the probability that an isolated single fiber breakage generating further fiber fractures in its neighborhood. Two mathematical models are used; one describes a random fiber array with an ideal elastic matrix and perfect fiber matrix bonding, while the other describes a regular fiber array with an elastic-plastic matrix or imperfect fiber matrix bonding. It is demonstrated that individual fiber stength is the dominant parameter governing fiber fracture probabilities in the neighborhood of a single fiber breakage. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-12126 Syracuse Univ., N. Y.
THE MAGNETIC SUSCEPTIBILITY OF THE LIQUID BISMUTH-INDIUM ALLOY SYSTEM Ph.D. Thesis
Howard Robert Leo 1979 156 p
Avail: Univ. Microfilms Order No. 7925577

Magnetic susceptibility was chosen as the method of investigation since it is sensitive to the electronic structure of both the conduction electrons and the ion cores of metals. It can thus be used not only as a means of detecting molecularity in a liquid alloy, but it can also yield information as to the nature of the interatomic forces if they exist. In order to carry out the investigation a very sensitive high temperature Faraday susceptibility apparatus was constructed. The design and operation of the apparatus are described in detail. The magnetic susceptibilities of pure bismuth and indium were measured from their melting points to 450 C and 500 C respectively. The gram-susceptibility of pure bismuth at its melting point was determined to be -0.0412 x 10 to the -6th power cgs-emu/g, and that of pure indium was determined to be -0.0799 x 10 to the -6th power cgs-emu/g. The susceptibility of both metals increased linearly with temperature. The temperature coefficient of the susceptibility of bismuth was found to be 3.44 x 10 to the -11th power cgs-emu/g C, and that of indium was found to be 2.18 x 10 to the -11th power cgs-emu/g C. Dissert. Abstr.

N80-12127 Michigan Univ., Ann Arbor.
SPECTROSCOPIC AND OPTICALLY DETECTED MAGNETIC RESONANCE STUDIES OF PO2(-) IN POTASSIUM CHLORIDE Ph.D. Thesis
Susan Joy Hunter 1979 233 p
Avail: Univ. Microfilms Order No. 7925164

The phosphorescence, optically detected magnetic resonance (ODMR), and photo-reorientation of phosphorus activated single crystals of potassium chloride were examined at 4.2 K. The impurity center responsible for the emission from these crystals was identified by isotopic substitution as PO2(-). The vibrational frequencies were used to compute the valence bond angle and the normal coordinates of the totally symmetric ground state modes. The geometrical changes associated with excitation to the lowest triplet state were also computed for comparison with the results of similar calculations and measurements for other 18 electron AB2 type molecules. The ODMR spectra, obtained in zero field for PO2(-) in both KCl and KBr lattices, yielded the fine structure parameters D and E of the lowest triplet state. The temperature dependence of the rate of photo-reorientation was determined and a potential energy calculation was performed for rotation about several simple and compound molecular axes. Dissert. Abstr.

N80-12128 Iowa State Univ. of Science and Technology, Ames.
THE METHANATION REACTION ON RUTHENIUM THIN FILMS: A MECHANISTIC INVESTIGATION Ph.D. Thesis
Michael Dwayne Slaughter 1979 183 p
Avail: Univ. Microfilms Order No. 7924272

The kinetics of the methanation reaction were measured on ruthenium thin films in the temperature range 548 to 623 K. The CO kinetic order varied from +1 at low pressures to -2 at high pressures. As the H2 pressure was increased its kinetic order varied from +2 to -1. The reaction is zero order in both CH4 and H2O. The apparent activation energy was dependent upon temperature. Both the H2/D2 and the (C-13)(O-18)/(C-12)(O-16) isotopic exchange reactions proceeded rapidly on the thin

film at 573 K. The surface was always covered with carbon, but no oxygen was ever detected on the surface after methanation. A mechanism was developed which quantitatively fits the kinetic data and qualitatively predicts all of the other observations. This mechanism involves adsorbed hydrogen interacting with nondissociated carbon monoxide. The rate limiting step involves the interaction of Ru-H and Ru-CH3 to form methane. A methylene carbonyl hydride is believed to act as a reversible poison at high H2:CO ratios. Dissert. Abstr.

N80-12129 City Univ. of New York, N. Y.
TARGET FACTOR ANALYSIS OF GAS-CHROMATOGRAPHIC RETENTION INDICES Ph.D. Thesis
Joseph Moshe Soroka 1979 297 p
Avail: Univ. Microfilms Order No. 7923770

Target factor analysis, a multivariate statistical technique, is applied to the analysis of gas chromatographic (GC) retention index data. Eight matrices of GC data are analyzed to provide basic insights into the solute-solvent interactions. Particular attention is applied to the analyses of the solvent contribution. Possible recommendations for selections of standard stationary phases are made including equivalences of various solvents. Dissert. Abstr.

N80-12130 Boston Univ., Mass.
PHASE TRANSITIONS AND STATISTICAL MECHANICS OF LIPID BILAYERS SYSTEMS Ph.D. Thesis
John Day 1979 203 p
Avail: Univ. Microfilms Order No. 7923924

Laser Raman spectroscopy is used to study the microscopic state of specifically deuterated groups of the hydrocarbon chains in lipid-water dispersions. The gel to liquid crystal phase transitions that occur in lipid systems are monitored by measuring the broadening of the Raman line widths that occur at the phase transition as a function of the rotational freedom of the CD2 groups in the liquid crystal phase. Raman spectra were taken of a series of labeled carbon positions of dimyristoyl-, dipalmitoyl-, and distearoyl phosphatidyl choline. The samples were prepared in the forms of lipid-water dispersions. The spectra were taken at temperatures below and above the phase transition temperatures for these systems. The full widths of the deuterated peaks show a discrete change at the phase transition temperature for all the labeled positions except the symmetric peak of the 3 position of dimyristoyl phosphatidyl choline. Dissert. Abstr.

N80-12131 Columbia Univ., New York.
SUPERFLUID HELIUM THREE: SOME HYDRODYNAMIC MEASUREMENTS Ph.D. Thesis
Joseph K. Lyden 1979 176 p
Avail: Univ. Microfilms Order No. 7924933

The design of an oscillating viscometer to measure the superfluid fraction and normal fraction viscosity of Helium Three in the A and B phases above two millikelvin is presented. A basically parallel plate geometry, low flow velocities, and magnetic shielding are used to obtain the conditions necessary for measuring only one selected component of the superfluid fraction and normal fraction viscosity tensors in the A phase. A discussion of the period and damping data in the superfluid phases which displayed prominent resonance phenomena is presented. Properties of the superfluid phases are discussed. Dissert. Abstr.

N80-12132 Michigan Univ., Ann Arbor.
THE DETERMINATION OF TRACE METALS IN POWDER MICRO SAMPLES USING EXPLODING THIN FILM ATOMIZATION AND EXCITATION Ph.D. Thesis
Elke Monika Antje Clark 1979 141 p
Avail: Univ. Microfilms Order No. 7925133

The direct determination of trace metals in powder micro samples is explored using thin metal films electrically exploded by capacitive discharge as atomization cells and excitation sources for atomic emission spectroscopy. Emphasis is placed on the analysis of refractory materials prepared as alcoholic suspensions of their powder. A parametric study is presented, which explores the variations in atomic emission line intensities from the thin film and the analyte species, for different voltage/capacitance combinations in the discharge power source as well as different plasma support gas pressures. The feasibility of using the exploding thin film method for the determination of metals in airborne particulate matter collected on metallized filters was explored. Dissert. Abstr.

N80-12133 Rhode Island Univ., Kingston.
CHARACTERIZATION OF OXIDATION PRODUCT FILMS ON LEAD IN AQUEOUS MEDIA BY IN SITU RAMAN SPECTROSCOPY Ph.D. Thesis
Richard James Thibeau 1979 164 p
Avail: Univ. Microfilms Order No. 7925397

Raman spectroscopy was used to determine the composition of surface films formed on lead by exposure to aqueous solutions of several different compositions. Controlled potential exposures of lead in phosphate, carbonate, chloride, and sulfate solutions were conducted under various conditions of potential and pH. The results of spectroscopic identification of the compounds present in insoluble surface films were compared to theoretical Pourbaix diagrams for lead in simple solutions of the appropriate ions and to potentiodynamic polarization curves for the solutions used. Raman spectra of thin oxide films formed on iron by high temperature oxidation were obtained. Dissert. Abstr.

N80-12134 Wisconsin Univ. - Madison.
PHOTOCHEMISTRY AND PHOTOPHYSICS OF FORMYL FLUORIDE Ph.D. Thesis
Sherwin Toshio Amimoto 1979 250 p
Avail: Univ. Microfilms Order No. 7919785

Formyl fluoride photochemistry was investigated using: (1) small signal gain probing of HF vibrational states; (2) the observation and characterization of high overtone CH stretch transitions using intracavity photoacoustic spectroscopy;(3) relative gain measurements in the HF chemical laser to obtain the HF vibrational distribution; and (4) the fluorescence quantum yield measurements of the excited singlet state of HFCO. The weak 6-0 and 5-0 CH stretches of HFCO observed by intracavity photoacoustic spectroscopy were assigned to the pure CH stretching and to combination bands of HFCO. The single vibronic level fluorescence quantum yields had an exponential dependence on vibrational energy and a large isotope effect of approximately 50. By analogy with H2CO, it was concluded that internal conversion by nuclear momentum coupling is not significant and that direct coupling to a continuum is probably important. Dissert. Abstr.

N80-12135 Wisconsin Univ. - Madison.
MICROWAVE SPECTROSCOPY OF THE FORMYL ION, HYDROGEN ISOCYANIDE, AND THE HYDROXYL RADICAL Ph.D. Thesis
Thomas Gordon Anderson 1978 265 p
Avail: Univ. Microfilms Order No. 7918134

The technique of using a d.c. discharge as the absorption cell of a microwave spectrometer was used to obtain microwave spectra of the formyl ion hydrogen isocyanide, and the hydroxyl radical. The formyl ion J=0-1 transition frequency and Doppler Shift were observed for six isotopically substituted species. Rest frequencies were used to determine a complete substitution structure for all the isotopic forms. The pressure broadening of the formyl ion J=0-1 absorption line by hydrogen was also measured and the pressure dependence of the linewidth was determined for the formyl ion transition broadened by H2 at 100 K. All three vibration-rotation interaction constants were determined for the hydrogen isocyanide main isotopic species by combining high resolution infrared studies with the measurements of the J=0-1 transition in the ground state and the v sub 1, v sub 3, and v sub 2 excited states. The lambda doublet transitions of the hydroxyl radical were measured in the region of 8-40 Ghz and an effort was made to develop a theoretical model for calculating the transition frequencies. Dissert. Abstr.

N80-12136 North Carolina Univ. at Chapel Hill.
NUMERICAL SOLUTIONS TO PROBLEMS IN LIQUID MEMBRANE ELECTROCHEMISTRY Ph.D. Thesis
Frederick Scott Stover 1979 213 p
Avail: Univ. Microfilms Order No. 7925971

The method and results of a digital simulation of electrochemical properties for associated and nonassociated liquid ion-exchange membranes are presented. Concentration profiles, potentiometric responses, transient potential responses to activity steps, and current-voltage curves are given and the effects of ion-pairing

and species mobilities are studied. It is found that ion-pairing increases the potentiometric selectivity toward the complexing ion, as does high site mobility. Transient responses to an ion activity step are shown to depend in a complex way on the ion-pair formation constant and the various mobilities. Current-voltage curves are simulated for varying degrees of ion-pairing and quantitative agreement is found in those cases where closed-form expressions are known. Dissert. Abstr.

N80-12137 North Carolina Univ. at Chapel Hill.
SEARCH ALGORITHMS AND RELATED TECHNIQUES FOR THE ANALYSIS OF SPECTROMETRIC DATA Ph.D. Thesis
Gregory Terrance Rasmussen 1979 172 p
Avail: Univ. Microfilms Order No. 7925959

The use of search algorithms with mass spectral data is examined. A data compression method based on fractional ion currents of specific ion series within mass spectra is reported, and the potential for implementing an efficient search system employing this compression method is assessed. Infrared spectral searches which rely on detailed intensity information and those based on peak position information are compared using trial searches with a library of five hundred spectra. Three different distance metrics are evaluated for searches using intensity information, and the effects of selecting data from limited regions of the infrared spectrum are examined. Mathematical techniques for the identification of components in mixtures from the mass spectra of a series of related mixtures are described. The approach is analogous to library search methods in that spectra from a reference collection are compared with an unknown. Dissert. Abstr.

N80-12138 North Carolina Univ. at Chapel Hill.
APPLICATION OF MINI-AND MICROCOMPUTER TECHNIQUES TO PROBLEMS IN ANALYTICAL CHEMISTRY Ph.D. Thesis
Jerry Paul Koontz 1979 458 p
Avail: Univ. Microfilms Order No. 7925939

Two high performance multifunction real time data acquisition and instrument control interfaces implemented for Raytheon 704 and Mod Comp 2 minicomputers are described. Software for machine to machine communications and microcomputer down loading from the host was developed. Several peripheral controllers were constructed for the UNC microcomputer system: a general purpose keyboard interface, an asynchronous serial communications module, a 333 KHz analog to digital converter, and a four channel digital to analog converter. This technology was applied to Fourier transform nuclear magnetic resonance experiments and spectral searches over a large (91875 spectra) infrared data base. Dissert. Abstr.

N80-12139 North Carolina Univ. at Chapel Hill.
STUDIES IN ANALYTICAL SPECTROSCOPY. 1. COMPUTER TREATMENT OF SPECTROSCOPY DATA. 2. RESONANCE RAMAN SPECTROELECTROCHEMISTRY Ph.D. Thesis
Harvey Saul Gold 1979 317 p
Avail: Univ. Microfilms Order No. 7925919

A number of interrelated topics in the field of analytical spectroscopy are examined. A computer spectral decomposition program developed to address a wide range of experimentally significant problems while maintaining ease of use is described. The establishment of a laser Raman facility for research in the field of resonance Raman spectroelectrochemistry is described. Results of studies of a number of model and test systems are presented. Studies of several polycyclic aromatic hydrocarbons in solution and their sodium- and electro-generated anions are discussed along with an evaluation of the instrumental capabilities. Dissert. Abstr.

N80-12140 Pennsylvania State Univ., University Park.
VACANCY SOLUTION AND TWO-DIMENSIONAL GAS MODELS FOR GAS MIXTURE ADSORPTION Ph.D. Thesis
Solot Suwanayuen 1979 193 p
Avail: Univ. Microfilms Order No. 7922354

Four correlational methods for predicting binary gas mixture adsorption equilibria from single component isotherm data were developed and tested. In these methods three approaches were used to describe the adsorption system: (1) the vacancy solution model, (2) the two dimensional gas equation of state, and (3) the adsorbed solution theory. In the vacancy solution model, the adsorption equilibrium is treated as an osmotic equilibrium between two vacancy solutions having different compositions. In the two dimensional gas model, the virial equation of state as well as the equation of state taken from the vacancy solution theory were used to derive the binary correlations. From the third approach, a new ideal adsorbed solution correlation was derived by taking the total adsorption pressure of the mixture as the standard state. Dissert. Abstr.

N80-12141 Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTROLESS (CHEMIPHORETIC) DEPOSITION OF POLYMER LATEX ON A RAPIDLY-DISSOLVING STEEL SUBSTRATE Ph.D. Thesis
Ronald Evan Smith 1979 215 p
Avail: Univ. Microfilms Order No. 7925027

A process for applying organic polymer coatings to steel surfaces is studied. The process, termed chemiphoretic deposition, or chemiphoresis, is used commercially. The process resembles the well-known process of electrodeposition used for polymer coating, except that no external electric field is applied. The combination of acid and hydrogen peroxide is extremely corrosive, resulting in rapid dissolution of a steel substrate when immersed in the bath. The rate of deposition of latex onto the steel substrate is proportional to the rate of metal dissolution. It is concluded that the coating deposition rate is controlled by a local electric field formed at the steel/aqueous interface. This field results from the diffusion of ionic species toward and away from the steel during dissolution. Dissert. Abstr.

N80-12142*# Pennsylvania State Univ., University Park.
INVESTIGATION OF CRITICAL BURNING OF FUEL DROPLETS Final Report, 1 Sep. 1966 - 30 Jun. 1979
G. M. Faeth Jul. 1979 87 p refs
(Grant NGR-39-009-077)
(NASA-CR-159697) Avail: NTIS HC A04/MF A01 CSCL 21B

The general problem of spray combustion was investigated. The combustion of bipropellent droplets; combustion of hydrazine fuels; and combustion of sprays were studied. A model was developed to predict mean velocities and temperatures in a combusting gas jet. R.C.T.

N80-12143# Army Construction Engineering Research Lab., Champaign, Ill.
DURABILITY AND FIRE-SPREAD ASPECTS OF PLASTIC PIPE SYSTEMS Final Report
Alvin Smith and R. Brady Williamson Jul. 1979 68 p refs
(DA Proj. A47-62731-AT-41)
(AD-A073031: CERL-TR-M-264) Avail: NTIS HC A04/MF A01 CSCL 13/11

This report presents the findings of the two studies of commercially available thermoplastic pipe now in widespread use for water distribution, drain-waste-vent (DWV), sewage, and plumbing systems. One study dealt with the long-term performance of plastic pipe and drew information from users' experience. The other study concerned accumulation of test data on fire spread in structures having plastic pipe in interior plumbing and DWV systems. Results of the two studies indicate that plastic pipe is very durable in long-term service as predicted by short-term tests and that while most plastic pipe will burn in established building fires, the fire spread potential is not great. Designs that further limit fire spread are given. GRA

N80-12144# Harvard Univ., Cambridge, Mass. Gordon Mckay Lab.
QUASICONTINUUM PHYSICS Annual Summary Report, 1 Jul. 1978 - 30 Jun. 1979
Eli Yablonovitch Aug. 1979 18 p refs
(Contract N00014-78-C-0531)
(AD-A073117) Avail: NTIS HC A02/MF A01 CSCL 20/10

We summarize the progress made in the first year of our research project. We are progressing in two research directions: (a) infrared-infrared double resonance and (b) infrared-visible double resonance. The first of these probes intramolecular dynamics in the phase space of polyatomic molecules while the second probes molecular distributions along the energy axis. In this connection we have, for the first time, infrared multiphoton

pumped the electronically excited state of a molecule, with a corresponding effect on its visible fluorescence. GRA

N80-12145# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
FLAME - A SLOW-FLOW COMBUSTION MODEL
Walter W. Jones and Jay P. Boris 16 Jul. 1979 37 p
(RR0110941; RR0240241)
(AD-A072988; NRL-MR-3970) Avail: NTIS
HC A03/MF A01 CSCL 21/2

We have developed a two-dimensional, time-dependent reactive flow model for studying the various aspects of combustion, including ignition, flame spread and plume formation. The basic model is a self-consistent slow-flow hydrodynamic algorithm with chemical reactions. Also included are the basic transport processes of molecular diffusion and thermal conductivity. The model is implemented so that other physical mechanisms, such as different chemical reaction schemes, turbulence models, heterogeneous phenomena, etc., can be included on a modular basis. GRA

N80-12146# Illinois Univ. at Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES Interim Report, 1 Jun. 1978 - 31 May 1979
Roger A. Strehlow, Harold O. Barthel, and Herman Krier Jul. 1979 71 p refs
(AF-AFOSR-3336-77; AF Proj. 2308)
(AD-A073058; AFOSR-79-0934TR) Avail: NTIS
HC A04/MF A01 CSCL 21/2

The research deals with the broad topics of initiation, combustion and transition to detonation in homogeneous and heterogenous reactive mixtures. One specific area deals with analytical and experimental work directed to direct initation of detonation by a nonideal blast wave in chemically sensitized reactive fuel-air clouds. The other specific topic involves the hydrodynamic modeling of ignition and flamespreading in granular energetic solids to predict the potential for deflagration (DDT). GRA

N80-12147# Hanford Engineering Development Lab., Richland, Wash.
MATERIALS COMPATIBILITY IN LIQUID SODIUM
W. F. Brehm Aug. 1978 38 p refs Presented at NACE Conf., Denver, Colo., 3 Oct. 1978
(Contract EY-76-C-14-2170)
(HEDL-SA-1559; Conf-781071-2) Avail: NTIS
HC A03/MF A01

The types and rates of reaction of sodium with reactor materials are presented. Confident predictions on the corrosion behavior for steel in sodium were obtained. Deposition phenomena are not well defined, at least with respect to establishing quantitative correlation. The potential uses of liquid metal heat transfer systems in energy conversion systems other than nuclear reactors were considered. DOE

N80-12148# Sandia Labs., Albuquerque, N. Mex.
RAYLEIGH TEMPERATURE PROFILES IN A HYDROGEN DIFFUSION FLAME
J. R. Smith Sep. 1978 11 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8726) Avail: NTIS HC A02/MF A01

Rayleigh scattering from a hydrogen-air laminar jet diffusion flame in combination with a numerical model of the flame was used to determine temperature profiles. The model predictions of species concentration are used to calculate a mean Rayleigh cross-section which is used to relate the Rayleigh scattered intensity to temperature. Using an argon ion laser producing 7.5 watts at 488 nm and an optical multichannel analyzer the scattered light was imaged into a spectrometer. Spatial resolution of 0.18 mm on each of the 500 detector elements with good signal-to-noise ratios was achieved even with integration times of only 0.03 second. Since the entire profile is made simulataneously, particulate perturbed profiles are easily recognized and discarded. Transverse profiles are presented to show structure. Axial profiles are compared to radiation corrected thermocouple measurements. DOE

N80-12149# California Univ., Berkeley. Lawrence Berkeley Lab.
OPERATION OF A HIGH-CURRENT XENON SOURCE
W. Chupp, D. Clark, R. Richter, J. Staples, and E. Zajac Mar. 1979 4 p ref Presented at IEEE Particle Accelerator Conf., San Francisco, 12 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8859; CONF-790327-108) Avail: NTIS
HC A02/MF A01

A multi-aperture Ehlers-type source was constructed and operated to produce a 60 mA Xe(+1) beam. The multi-aperture source utilizes a 13 hole aperture in a circular pattern producing a beam 25 mm in diameter. An accel-decel extraction system was used, producing a 22.5 keV beam whose normalized emittance at 29 mA was 0.027 pi cm-mrad. The neutralized beam was transported one meter through two magnetic quadrupole triplets to the entrance of a 20 cm accelerating gap consisting of five intermediate electrodes with a total voltage drop of 500 kV. The vacuum in the extraction region was held to 0.00001 Torr by using a puff valve and two 1500 l/sec turbo pumps. Multi-wire profile monitors just ahead of the column entrance measured the beam size, which was in good agreement with single-particle transport calculations. DOE

N80-12150# Sandia Labs., Albuquerque, N. Mex.
HIGH RESOLUTION FOURIER TRANSFORM INFRARED SPECTROSCOPY FOR THE INVESTIGATION OF DECOMPOSITION GASES GENERATED BY AGING ORGANIC MATERIALS
D. M. Haaland and G. E. Rivord 1979 6 p refs Presented at JOWOG-2B, Albuquerque, N.M., 11 Jun. 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0935C; CONF-790632-6) Avail: NTIS
HC A02/MF A01

A 10 year program to determine the long-term ambient temperature aging characteristics of pentaerythritol tetranitrate (PETN) and hexanitrostilbene (HNS) in explosive components is described. Because of the limited supply of components and the desire to study the aging process at temperatures as close to ambient as possible, a sensitive, nondestructive technique such as Fourier transform infrared spectroscopy (FTIR) is required. Of the major decomposition gases to be monitored (CO, CO2, H2O, NO, NO2, N2O, and N2) only N2 is not infrared active. Preliminary investigations of the FTIR method prior to its application to actual explosives are reported. DOE

N80-12151# European Space Agency, Paris (France).
INFLUENCE OF TURBULENCE ON HYDROCARBON COMBUSTION IN A STIRRED COMBUSTOR Ph.D. Thesis - Paris Univ.
Claude Bonniot Jul. 1979 76 p refs Transl. into ENGLISH of "Influence de la Turbulence sur la Combustion d'Hydrocarbures dans un Foyer 'homogene'", ONERA, Paris Report ONERA-NT-1978-7, 1978 Original report in FRENCH previously announced as N79-32315
(ESA-TT-580; ONERA-NT-1978-7) Avail: NTIS
HC A05/MF A01

The reciprocal influence of turbulence and combustion was determined for the case of homogeneous turbulence, which corresponds to the primary zone of turbomachine combustors. A method was developed to calculate the statistic characteristics of the flame and experiments were carried out on a stirred at large scale combustor. The results of optical temperature measurements show that the combustor presents good homogeneity. The maximum characteristic mixing time is much lower than the mean residence time in the combustor. The influence of equivalence ratio fluctuations at injections was also studied. A simple calculation predicts these ratios in the case of fluctuations with a low frequency relative to residence time. In the case of high frequency fluctuations, the calculations and experiments agree well qualitatively, but not quantitatively. Author (ESA)

N80-12152# Little (Arthur D.), Inc., Cambridge, Mass.
GAS SAMPLE STORAGE Final Report, Jan. 1978 - Feb. 1979

K. E. Thrun, J. C. Harris, and K. Baltis Apr. 1979 49 p refs
(Contract EPA-68-02-2150)
(PB-298350/0; EPA-600/7-79-085) Avail: NTIS
HC A03/MF A01 CSCL 14B

Results are presented of a laboratory evaluation to compare the storage stability of selected gases covering a range of compound categories, in three types of containers: glass bulbs and two different polymeric sample bags. It was concluded that glass bulbs are the best overall choice, with no significant gas losses. Reactive and highly polar gases were preferentially lost from samples stored in the polymeric bags. Some contaminants were detected in the samples taken from the polymeric sample bags, presumably the result of outgassing from the materials used to construct the bags. GRA

N80-12152# TRW Defense and Space Systems Group, Redondo Beach, Calif.
APPROACHES TO LEVEL 2 ANALYSIS BASED ON LEVEL 1 RESULTS, MEG CATEGORIES AND COMPOUNDS, AND DECISION CRITERIA Final Report, Dec. 1976 - Dec. 1978
L. E. Ryan, R. G. Beimer, and R. F. Maddalone Feb. 1979 164 p refs
(Contract EPA-68-02-2613)
(EPA-600/7-79-063A) Avail: NTIS HC A08/MF A01 CSCL 07D

An approach to the decision criteria needed to proceed from the initial emission screening analysis (Level 1) to the detailed emission characterization (Level 2) is described. The types of Level 1 environmental assessment samples, and the chemical data available which can be prioritized for a MEG-based Level 2 plan are discussed and a logic network for determining the need for a Level 2 sampling effort is presented. An integrated approach to Level 2 inorganic compound analysis, an identification scheme consisting of characterization of the initial sample, of bulk composition, and of individual particles is included along with detailed logic networks to provide direction to the analyst during the identification process. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-12154 Clemson Univ., S.C.
STORED ENERGY IN THE I SUB b SUBSTAGE OF ALUMINUM Ph.D. Thesis
Bruce Warren Koehn 1979 95 p
Avail: Univ. Microfilms Order No. 7925095

An attempt was made to measure the stored energy due to point defects in the crystal lattice of aluminum. The experimental technique makes use of differential thermal analysis. A technique in indirect thermometry was attempted where the temperature change due to release of stored energy was to be inferred by the enhanced recovery caused by the release of stored energy during a comparatively rapid thermal annealing pulse. A sample mounting technique was tested. Two data analysis methods were used to show that stored energy was not detected in any of the experiments. Even though no stored energy was detected, the basic principles of this work are still applicable, as shown by theory, and deserve further study. The analysis presented points to some of the major problems, provides quantitative estimates of some experimental values, and gives a basis for extending these types of measurements. Author

N80-12155 Clarkson Coll. of Technology, Potsdam, N.Y.
MAGNETIC SUSCEPTIBILITY OF CHROMIUM AND ITS ALLOYS Ph.D. Thesis
Jack Robert Kelly 1979 174 p
Avail: Univ. Microfilms Order No. 7925430

The static spin susceptibility of antiferromagnetic chromium containing nonmagnetic impurities is calculated using a two-band model. Variation in the size of the electron jack and hole octahedron upon alloying is taken into account within the rigid band approximation. The effect of phonon scattering on the susceptibility is included. The theory is compared with experimental results on binary chromium alloys containing dilute amounts of ruthenium and rhenium. A simplified version of the spin Hamiltonian which takes account of nearest neighbor exchange coupling of the local moments as well as their coupling to the spin density wave is presented. For dilute moment concentrations, semiquantitative agreement with experiments on Cr-Fe and Cr-Co systems can be obtained with a strong interaction between the moments and the spin density wave. Dissert. Abstr.

N80-12156 Michigan Univ., Ann Arbor.
STUDIES OF ULTRAFINE METAL PARTICLES Ph.D. Thesis
Stephen Ross Forrest 1979 219 p
Avail: Univ. Microfilms Order No. 7925149

Experiments which measure charged particle velocity and mobility are described. From the distribution in mobility, the particle size distribution is inferred. The size distribution is approximately log-normal with a median radius 1.5 times larger than obtained by electron microscopy measurements. Possible causes for the discrepancy are discussed. The distribution width parameter for the two measurement techniques is the same. An advantage of the mobility method is the immediate availability of the size distribution. A type of magnetic resonance expected in free, small, ferromagnetic particles is presented and a resonance spectrometer is built to detect it. The spectrometer includes a preamplifier which operates at liquid helium temperatures, and a superconducting rf coil. It produces either oscillation or rotating rf fields. The predicted resonance was not detected. Dissert. Abstr.

N80-12157 Western Reserve Univ., Cleveland, Ohio.
PASSIVATION STUDIES OF IRON, NICKEL, AND THEIR ALLOYS BY IN SITU ELLIPSOMETRIC AND EX SITU ESCA TECHNIQUES Ph.D. Thesis
Chia-Tien Chen 1979 223 p
Avail: Univ. Microfilms Order No. 7924812

The optical spectra of passive films on iron in borate buffer (pH = 8.4) were determined for wavelengths from 350 to 760 nm. The spectral properties of poly- and single crystal alpha-Fe2O3 were also examined and show distinct differences for the spectra of the passive film. A detailed mechanistic model for the reduction stages is proposed. The calculated transition times for the reduction stages can be fitted reasonably well with those determined ellipsometrically. The ex situ ESCA spectra on passive iron electrodes indicate changes in the oxygen peaks with oxide formation potential which are explained in terms of protons in the film. The ESCA studies were extended to high chromium steel. In the transpassive region, chromium was completely depleted within the film, at least within the escape depth for the electron. Dissert. Abstr.

N80-12158 Iowa State Univ. of Science and Technology, Ames.
THERMODYNAMIC STUDY OF LIQUID CERIUM AND COPPER ALLOYS BY LEVITATION CALORIMETRY Ph.D. Thesis
Won Dokko 1979 161 p
Avail: Univ. Microfilms Order No. 7924239

The electromagnetic levitation method of heating a sample along with conventional isothermal drop calorimetry was applied to determine the heat content and the heat capacity of liquid cerium-copper alloys over the complete range of composition. The temperatures of the levitated samples were determined by means of an automatic optical pyrometer. The normal spectral emissivities (lambda = 645 nm) of the binary liquid alloys were measured over the complete range of composition by an integral blackbody comparison method. It was found that the normal spectral emissivities are constant over the experimental temperature range, from approximately 1120 K to 1700 K. Dissert. Abstr.

N80-12159# Naval Postgraduate School, Monterey, Calif.
FRACTURE TOUGHNESS CHARACTERIZATION OF SELECTED ULTRA HIGH CARBON STEELS M.S. Thesis
James Louis Taylor Jun. 1979 75 p refs
(AD-A073395) Avail: NTIS HC A05/MF A01 CSCL 11/6

This effort, part of an ongoing program examining the microstructural and mechanical properties of extensively warm-worked ultra high carbon (UHC) steels, was directed at measurement of the fracture toughness of these steels. A facility was constructed to test bend-type fracture toughness specimens

in accordance with the American Society for Testing and Materials (ASTM) Standard E399-78; several UHC steel alloys were evaluated and the results correlated with microstructural and other mechanical test results. With one exception, processing failed to eliminate coarse carbides from the microstructures of these materials and fracture toughness, K(IC), values were accordingly low. A commercial alloy, AISI 52100, processed similarly to the other experimental alloys, did not have the coarse carbides present to as great an extent, and was significantly tougher, as manifested by a strength ratio twice that of the other alloys. GRA

N80-12160# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF THE USE OF CORROSION INHIBITORS AT THE ANODIC OXIDE-METAL INTERFACE Final Report, May 1978 - Apr. 1979

Neil T. McDevitt and James S. Solomon Jul. 1979 24 p refs

(AF Proj. 2416)

(AD-A073124; AFML-TR-79-4090) Avail: NTIS HC A02/MF A01 CSCL 11/6

Aluminum alloy, 2024, was treated with a number of solutions having corrosion inhibitor properties. These surfaces were then anodized in a H3PO4 acid electrolyte. After anodization, the specimens were dipped into a 10% salt solution. A chromate solution-anodized composite film showed some corrosion improvement when compared to a standard phosphoric anodized specimen. GRA

N80-12161# Martin Marietta Labs., Baltimore, Md.

AUGER ELECTRON SPECTROSCOPY STUDIES OF OXIDE FILMS ON Al-Zn-Mg ALLOYS

R. K. Viswanadham, T. S. Sun, and J. A. S. Green Jul. 1979 17 p refs

(Contract N00014-74-C-0277)

(AD-A073096; MML-TR-79-33) Avail: NTIS HC A02/MF A01 CSCL 11/6

Auger electron spectroscopy and depth profiling have been used to obtain information on the composition of oxide films formed on high purity Al-5.5Zn-2.5Mg alloys as a function of heat treatment, grain size, storage environment and temperature. These studies show that in the as-heat-treated condition the oxide film is predominantly MgO. The Mg/O peak-to-peak height ratio of this oxide is sensitive to the heat treatment temperature and exhibits a maximum at 475 C. During subsequent storage, especially in a moist environment, this film undergoes substantial changes in composition. The Mg/Al ratio of the oxide decreases due to formation of an Al-rich oxide on top of the as-heat-treated oxide. A model is proposed to account for the changes in the oxide film composition during growth of the Al-rich oxide, and possible implications to pre-exposure embrittlement and stress corrosion cracking are discussed. GRA

N80-12162# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.

STRUCTURE OF SOME REFRACTORY TRANSITION METAL METALLOID GLASSES

Arthur R. Williams and William L. Johnson Dec. 1978 15 p refs

(Contract EY-76-C-03-0822)

(CALT-822-105) Avail: NTIS HC A02/MF A01

The radial distribution function of four refractory alloys of composition (W sub 5 Ru sub 5) sub 8 M sub 2 where M = some metalloid are presented, along with densities, atomic volumes of metalloids and coordination numbers. The results are discussed and some comparisons made with some model calculations of dense random packings of hard spheres. DOE

N80-12163# International Nickel Co., Inc., Suffern, N. Y. Inco Research and Development Center.

EVALUATION OF HIGH CHROMIUM OVERPLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly Report, 1 Mar. - 31 May 1978

E. P. Sadowski 1978 32 p

(Contract EF-77-C-01-2621)

(FE-2621-3) Avail: NTIS HC A03/MF A01

Three-quarters of the welding is complete and pre-exposure testing started on one-half of the completed weldments in this program to produce overlays resistant to corrosion in coal gasification atmospheres at 982 C. The welding processes were: submerged-arc, gas metal-arc and gas tungsten-arc with a hot wire addition. Pre-exposure testing was continued. The tests consisted of hardness surveys, bend, tensile, stress-rupture, bulk chemical analysis of the overlay and microprobe analysis for the distribution of major alloying elements from the outside edge of the overlay to the center of the base plate. The results are described. DOE

N80-12164# Idaho National Engineering Lab., Idaho Falls.

OXIDATION AND EMBRITTLEMENT OF ZIRCALOY-4 CLADDING FROM HIGH TEMPERATURE FILM BOILING OPERATION

Stephen L. Seiffert and Richard Hobbins Dec. 1978 354 p refs

(Contract EY-76-C-07-1570)

(TFBP-TR-292) Avail: NTIS HC A16/MF A01

The results of an evaluation of the power cooling mismatch and irradiation effects test data on fuel rod cladding behavior are presented. Cladding embrittlement resulting from the high temperature oxidizing reactions with the coolant and the fuel was evaluated and comparisons with failure criteria are presented. The in-pile data are correlated with room temperature embrittlement criteria based on the fraction of remaining beta-phase, the total extent of oxidation, and the mean oxygen concentration near saturation in the beta-phase. The applicability of other failure criteria are discussed. The results show that the in-pile data are most consistent with criteria based on the mean oxygen content in the beta-phase, which suggests the critical effect of time and temperature upon the ultimate cladding oxygen distribution and on the extent of cladding embrittlement. DOE

N80-12165# Sandia Labs., Albuquerque, N. Mex.

NMR OF Cu SATELLITES IN THE KONDO ALLOY CuCr

L. J. Azevedo, D. Fallstaedt, and A. Narath 1978 10 p refs Presented at the 24th Conf. on Magnetism and Magnetic Mater., Cleveland, Ohio, 14 Nov. 1978

(Contract EY-76-C-04-0789)

(SAND-78-1514; CONF-781114-6) Avail: NTIS HC A02/MF A01

Using pulsed NMR techniques, resonances of Cu nuclei which are near neighbors to Cr impurities (c = 100 and 200 ppM) in CuCr were studied in the temperature range 1 to 4K and applied fields H sub 0 = 20 to 125 kOe. At the highest fields and lowest temperatures the satellite shifts approach saturation. Above near 40 kOe the spin-lattice relaxation rate 1/T sub 1 is proportional to T/H sub 0 squared, indicating that the dominant relaxation mechanism arises from transverse fluctuations of a polarized local moment. The measured rates yield a local-moment/conduction-electron exchange interaction vertical bar J sub 0 vertical bar/g = 0.30, where g is the Cr g-value. Below approximately 40 kOe/T sub 1 appears to be slightly enhanced in comparison with the high-field behavior, but becomes field independent below near 30 kOe. Both effects are attributed to Kondo anomalies. DOE

N80-12166# Foreign Resources Associates, Fort Collins, Colo.

EXPERIENCE WITH PERMANENT MODIFICATION OF ALUMINUM-SILICON CAST ALLOYS

K. Alker and U. Hielscher Aug. 1978 48 p Transl. into ENGLISH from Aluminum, W. Germany (Dusseldorf), v. 48, no. 5, 1972 p 362-367

(RFP-Trans-250) Avail: NTIS HC A03/MF A01

The inspection and testing of long term modified alloys in casting practice is reported. The alloys which can be used, as well as the batching, smelting, and melt treatment of such alloys are presented. Examples of the application of long term modified aluminum-silicon alloys are illustrated by several castings. DOE

N80-12167# Foreign Resources Associates, Fort Collins, Colo.

INCOMPATIBILITY OF SODIUM AND ANTIMONY IN THE TREATMENT OF ALUMINUM, SILICON ALLOYS

Sep. 1978 5 p ref Transl. into ENGLISH from Fondeur d'Aujourd'hui, France, no. 272, 1976 p 12-13

(RFP-Trans-256) Avail: NTIS HC A02/MF A01

Besides the classical modification treatment using sodium, the structure of aluminum-silicon alloys can be influenced by adding antimony. These two treatments are not compatible and the presence of antimony is detrimental to modification by sodium. Starting from an AS13 alloy with granular structure, sodium and antimony were added to obtain various structures. These structures vary as a function of sodium and antimony content for sand casting and chill casting. In the range examined, up to 0.8% determined antimony, it is possible to obtain modified structures by increasing the sodium dose when the content of antimony is increased. The treatment by sodium (or sodium-containing fluxes) eliminates part of the antimony from the alloy. By comparing the two diagrams, the limit of the lamellar structure is not very sensitive to the cooling rate. The range of good modification is very reduced for sand casting. Curious microstructures are observed where the traditional signs of under-modification and over-modification are practically superposed. DOE

N80-12168# Ames Lab., Iowa
ULTRAPURIFICATION OF REACTIVE METALS
D. T. Peterson 1979 13 p refs Presented at the Intern. Conf. on Advances in Chem. Met., Bombay, 3 Jan. 1979
(Contract W-7405-eng-82)
(IS-M-167) Avail: NTIS HC A02/MF A01

The development of advanced and more sensitive analytical methods and more sophisticated processing equipment to create the opportunity for further advances in the field of metal purification is presented. More detailed and quantitative examination of presently used purification methods reveal ways in which significant improvements in the results can be made. The need of highly purified metals in the continued advance of metallurgical research is stressed and examples of this need are cited. The cost of metal purification are considered. DOE

N80-12169# Sandia Labs., Albuquerque, N. Mex.
SOLDERABILITY
1978 9 p refs Presented at SME Seminar, Anaheim, Calif., 19 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1749C; CONF-780964-1) Avail: NTIS HC A02/MF A01

The problems in attaining good solderability, primarily printed circuit boards, testing for solderability and maintaining solderability over extended periods for electronic components, particularly those of copper, are addressed. DOE

N80-12170# Oak Ridge National Lab., Tenn.
DUCTILITY MINIMUM AND ITS REVERSAL WITH AGING IN COBALT-BASE SUPERALLOYS
J. P. Hammond Jan. 1979 31 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6824) Avail: NTIS HC A03/MF A01

Good mechanical properties in the face of long-term aging at high temperatures are required of superalloys for nuclear and solar power-conversion applications. Of special concern are losses in ductility and toughness resulting from microstructural instability. The tensile ductility responses in two cobalt-base superalloys were compared for the solution annealed and aged conditions and results were rationalized with contemporary concepts. The cobalt-base superalloys Haynes alloy No. 25 and Haynes alloy No. 188 show a pronounced ductility minimum at 760 C for the solution annealed condition. However, after prolonged (11,000 h) aging at 816 C, copious precipitates form and completely reverse this behavior. These precipitates drastically reduce tensile ductility up to the temperature at which the ductility begins to dip for the solution annealed condition; then the brittle behavior from aging gives way to greatly enhanced ductility. This behavior in Haynes alloy No. 25 was examined in detail. Tensile properties in the solution annealed and 816 C-aged conditions are correlated with mode of fracture and the amounts, identity, and morphology of the precipitates. The latter were assessed by optical and scanning electron metallography, microhardness, electron microprobe, and X-ray diffraction. The minimum and its reversal are explained by thermally activated processes that began with the onset of recovery. DOE

N80-12171# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
STRUCTURE AND PROPERTIES OF TRANSITION METAL-METALLOID GLASSES BASED ON REFRACTORY METALS
W. L. Johnson and A. R. Williams Jan. 1979 51 p refs
(Contract EY-76-C-03-0822)
(CALT-822-107) Avail: NTIS HC A04/MF A01

The structure of the alloys was investigated by X-ray diffraction methods and measurements of superconducting properties, electrical resistivity, density, hardness, and mechanical behavior were made. These data are used in developing a description of the structure of TM/sub 1-x/M/sub x/glasses. The experimental evidence suggests that an ideal amorphous phase forms at a specific composition x/sub c/ and that this phase has a well defined atomic short range order. For metallic glasses having x < x/sub c/ (metalloid poor glasses) vacancy-like defects form, which are characterized by the excess volume which they contribute to the glass. Another, as yet unspecified defect appears to form in glasses with x > x/sub c/. DOE

N80-12172# Oak Ridge Y-12 Plant, Tenn. Metallurgy Dept.
WELDABILITY OF ELECTROFORMED NICKEL
L. D. Frye 30 Mar. 1979 20 p refs
(Contract W-7405-eng-26)
(Y-2171) Avail: NTIS HC A02/MF A01

The cause of variations in the weldability of electroformed nickel was investigated. Evaluation of gas tungsten-arc welds in 0.254 mm thick electroformed nickel sheet by chemical analyses of the nickel base material identified phosphorus and sulfur contamination as the cause for welding variability. A screening test was developed that predicted the weldability of electroformed nickel. DOE

N80-12173# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
PROCEEDINGS OF THE WORKSHOP ON ALTERNATIVES FOR CADMIUM ELECTROPLATING IN METAL FINISHING
Elbert Dage, Edward Dyckman, William Isler, and Fielding Ogburn Mar. 1977 634 p refs Workshop held at Gaithersburg, Md., 4-6 Oct. 1977 Sponsored in part by Consumer Product Safety Commission, Commerce Dept., DOD, HEW, Interior Dept., DOL, and GSA
(PB-298841/8; EPA-500/2-79-003) Avail: NTIS HC A99/MF A01 CSCL 13H

Techniques were examined and alternatives pointed out to minimize the environmental losses of cadmium from electroplating by applying cadmium by mechanisms that reduce the loss of cadmium during plating, and developing suitable and cost-effective alternative materials, methods, and coatings. Presentations on the Federal and industrial concerns for the commercial significance, environmental effects, and health effects of cadmium were given. The topics 'Are specifications and standards barriers to change' and 'How essential is electrodeposited cadmium' were reviewed and discussed. GRA

N80-12017# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF SPUTTERING TO THE IMPROVEMENT OF COATINGS OF SUPERALLOYS
Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 94-124 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 181-194 Original language report was announced as A79-11135 Sponsored by DGRST (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-12174 Wisconsin Univ. - Madison.
OSCILLATORY FLOW BIREFRINGENCE MEASUREMENTS OF BLOCK COPOLYMERS IN SOLUTION Ph.D. Thesis

Alan Lewis Soli 1978 214 p
Avail: Univ. Microfilms Order No. 7919814

Oscillatory flow birefringence (OFB) was used to study the conformational dynamics of block copolymers in dilute solution. Experimental results for the OFB of block copolymers of styrene with either butadiene or isoprene (both linear and star topology) in a chlorinated biphenyl solvent are presented; these particular types of copolymers are of commercial interest because of their heterogeneous nature in the bulk or melt states. Results for copolymers of styrene and alpha-methylstyrene-which were previously determined as homogeneous in the bulk state-are also presented. The data for the linear copolymers qualitatively fits the bead-spring theory of F.W. Wang for block copolymers in solution. Included are OFB results for homopolymers to provide a basis for comparison with the copolymer studies.
Dissert. Abstr.

N80-12175 Michigan State Univ., East Lansing.
SYNTHESIS AND PHOTOPHYSICAL PROPERTIES OF A FLUORESCENT POLYAMIDE SERIES AND THEIR MONOMER ANALOGS: NOVEL INTRAMOLECULAR EXCIMER AND EXCIPLEX INTERACTIONS Ph.D. Thesis
John Akolisa Ibemesi 1978 265 p
Avail: Univ. Microfilms Order No. 7917717

The photophysical properties of a fluorescent aromatic polyamide-series and their monomer analogs were utilized to investigate: (1) the configurational and conformational requirements for intramolecular excimer formation in hetero-chain polymeric systems; (2) the effect of chain-binding on the reactivity of a chemical moiety; (3) the mechanism of solvent-induced intramolecular exciplex fluorescence in aromatic hydrocarbon-aliphatic amine systems; and (4) the nature of exciplex interaction with polar molecules. The room temperature absorption and emission spectra of dilute solutions of P-2, P-4, P-6 and P-8 were measured. Their emission spectra showed the formation of intramolecular excimers between naphthyl groups separated from one another by as many as 2O, 2N and 10C atoms. The fluorescence lifetimes and quantum yields were dependent on the distance of separation between the chromophores.
Dissert. Abstr.

N80-12176 Nevada Univ., Reno.
TEMPERATURE DEPENDENT TRIPLET ENERGY PROCESSES IN AROMATIC POLYMERS Ph.D. Thesis
Rafael Gonzalez Aviles 1979 135 p
Avail: Univ. Microfilms Order No. 7925405

The delayed fluorescence and phosphorescence intensities and lifetimes of poly(N-vinyl carbazole) (PVCA) solid films were measured at temperatures ranging from 77 K to 300 K. The presence of two trapped triplet species was confirmed. The delayed fluorescence intensity of radically polymerized PVCA films was found to possess a temperature dependence which includes a minimum at about 145 K and a maximum at about 200 K. The delayed fluorescence decay is multi-exponential over the temperature range studied but a fast component was isolated and was attributed to triplet-triplet annihilation involving mobile triplets formed directly by intersystem crossing of an excited singlet chromophore. The mobile triplet lifetime was found to have little temperature dependence and an average value of about 7 msec. Longer lived delayed fluorescence lifetimes in the low temperature region arise from interactions between trapped triplets and mobile triplets indirectly produced by detrapping.
Dissert. Abstr.

N80-12177# National Bureau of Standards, Washington, D.C. Polymer Science and Standards Div.
THE KINETICS OF HYDROLYTIC AGING OF POLYESTER URETHANE ELASTOMERS Technical Report, Sep. 1978 - Aug. 1979
Daniel W. Brown, Robert E. Lowry, and Leslie E. Smith Jul. 1979 25 p refs
(NR Proj. 356-647)
(AD-A072855; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

The hydrolytic degradation of polyester urethane elastomers is due to the acid catalyzed hydrolysis of the ester group. Acid content (A) and the reciprocal of the number average molecular weight increase by equivalent amounts indicating that each molecular chain scission produces one acid group. The fractional rate of increase in acidity, k, is a pseudo first order rate constant because the ester and water contents change only slightly with degradation. Values of k at 85 C and 100% relative humidity are in the 15-20% per day for polyurethanes, based on polycaprolactone and polytetramethylene adipate diols. At 100% relative humidity k obeys the Arrhenius equation between 35 and 85 C with activation energies in the range 68-83 kJ/mol (16-20 kcal/mol). Values of k decrease with relative humidity, becoming zero in dry air.
GRA

N80-12178# Queen Mary Coll., London (England). Dept. of Materials.
FRACTURE MECHANICS OF INELASTIC POLYMERS Final Report, 11 Apr. 1975 - 1 Oct. 1978
E. H. Andrews Apr. 1979 20 p refs
(Grant DA-ERO-75-G-049; DA Proj. 1T1-61102-BH-57)
(AD-A072792) Avail: NTIS HC A02/MF A01 CSCL 11/9

The author's Generalized Theory of Fracture Mechanics has been applied to several quite different polymeric materials which have in common a nonlinear and inelastic deformation behaviour. Thus the normal Linear Elastic Fracture Mechanics cannot be applied. When applied to experimental data the theory provides a unique characterization of fracture resistance and also sheds light on the molecular or microscopic fracture mechanisms of the material concerned.
GRA

N80-12179# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
EVALUATION OF AN ACOUSTIC TECHNIQUE AS A NONDESTRUCTIVE METHOD OF MEASURING UV DEGRADATION OF NYLON RIP-STOP FABRIC
Vasant K. Devarakonda Mar. 1979 21 p refs
(AD-A072817; CEMEL-201; NATICK/TR-79/031) Avail: NTIS HC A02/MF A01 CSCL 14/2

To determine whether the frequency of the resulting vibration could be used as a nondestructive method of evaluating degradation, samples of nylon rip-stop fabric with varying degrees of UV degradation were suspended under tension and impacted. It was found that the generated frequency is dependent on several variables including the vibrating length of sample and the applied tension. The suitability of the technique as a nondestructive method could not be established in this study because of lack of a definable relationship between frequency and degree of degradation.
GRA

N80-12180# Oklahoma Univ., Norman. Dept. of Chemistry.
THE CRYSTAL AND MOLECULAR STRUCTURE OF TRIMETHYLTIN CHLORIDE AT 135 K, A HIGHLY VOLATILE ORGANOTIN POLYMER
M. Bilayet Hossain, J. L. Lefferts, K. C. Molloy, D. VanDerHelm, and J. J. Zuckerman 27 Aug. 1979 11 p refs
(Contract N00014-77-C-0432)
(AD-A073641; TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/2

Trimethyltin chloride is the key starting material in the laboratory synthesis of the trimethyltin derivatives most subjected to study. It is an article of commerce, and has itself been extensively studied by a great variety of spectroscopic and physical methods. There is in the literature starting in 1970, a trail of oft referenced private communications (see our ref. 17) which describe a yet unpublished X-ray structure which is incorrect. In addition, the structure of the analogous triphenyltin chloride, which is monomeric at ambient temperature, is said to undergo a change on cooling to a chlorine-bridged polymer, but this suggestion is based upon NQR data at 77 K which cannot be reproduced (see our ref. 5). The structure of the homologous trimethyltin fluoride cannot be solved because of disorder, and thus the widely-quoted bridging halide structures for R3SnX compounds are being confirmed here in the case of the title compound for the first time.
GRA

N80-12181# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
FT-NMR DETERMINATION OF SILANE HYDROGEN
G. L. Clink Oct. 1978 6 p
(Contract EY-76-C-04-0487)
(MHSMP-78-45) Avail: NTIS HC A06/MF A01

A rapid and precise method for the analysis of silane hydrogen in prepolymers is presented. The catalysts used as well as comparisons of this proton nuclear magnetic resonance method with the wet chemical analysis are outlined. DOE

N80-12182# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
REPLICATION TECHNIQUE FOR EXAMINING DEFECTS IN THE INTERFACE OF A METAL-TO-GLASS CERAMIC BOND
R. K. Spears 22 Sep. 1978 20 p
(Contract EY-76-C-04-0656)
(GEPP-TIS-391) Avail: NTIS HC A02/MF A01

Epoxy replicas were made of the interface of a molybdenum and glass-ceramic assembly and examined by scanning electron microscopy. Replications of this interface were produced by first removing the molybdenum from four assemblies using a nitric acid-based etchant. The glass-ceramic insulators that remained were pressure encapsulated in epoxy. After curing, the glass-ceramics were etched from the epoxy in an hydrogen fluoride-based acid etchant. The resulting replicas resembled the texture of the molybdenum surface with the interface defects shown in detail as projections. This process revealed some unusual interface problems which appeared to be associated with the evolution of gas from the molybdenum piece parts. DOE

N80-12183# National Bureau of Standards, Washington, D.C.
PERFORMANCE OF PLASTIC PACKAGING FOR HAZARDOUS MATERIALS TRANSPORTATION. PART 4: STANDARDIZING PERMEATION MEASUREMENTS Final Report, Jun. 1978 - Jun. 1977
J. D. Barnes, G. M. Martin, and F. L. McCrackin Jun. 1979 48 p refs
(PB-298047/2; NBSIR-79-1768; DOT/MTB/OHMO-77/5) Avail: NTIS HC A03/MF A01 CSCL 11I

Experiments were performed which confirm the essential features of the permechor method for estimating the permeability of polyethylene to various liquids. A concept called the effective carbon atom number is introduced as a means of correlating data. Once the effective carbon atom number of a liquid is known from measurements on one kind of polyethylene, it should be possible to predict its permeability performance in containers made from different polyethylenes. Procedures are presented for implementing a standard-based system for measuring effective carbon atom numbers of various liquids and using information to make permeability performance predictions. This system minimizes the number of tests which must be made using full-scale containers. GRA

N80-12184# Howard, Needles, Tammen, and Bergendoff, Fairfield, N. J.
BRIDGE DECK JOINT-SEALING SYSTEM: EVALUATION AND PERFORMANCE SPECIFICATION Final Report
Jun. 1979 56 p refs Sponsored by Federal Highway Admin., Washington, D.C. and Am. Assoc. of State Highway and Transportation Officials, Washington, D.C.
(PB-298942/4; TRB/NCHRP/REP-204; LC-79-65828; ISBN-0-309-02910-4; ISSN-0077-5614) Avail: NTIS MF A01; HC available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C., 20428, $5.60 CSCL 13B

An investigation is reported on current and past use of prefabricated proprietary bridge deck joint-sealing systems by highway agencies throughout the U.S. and a number of other countries. The good features in a wide variety of products are examined; reported shortcomings in their serviceability under traffic (notably their failure to be entirely watertight) are searched out. The major contributory input to collection of field experiences with such systems was responses to a comprehensive questionnaire sent to all State highway departments and numerous toll authorities. Evaluations of all findings resulted in preparation of a practical and detailed performance specification for rubber membrane- and cushion-seal systems up to 4 in. (102 mm) total movement. (Cellular compression seals are not included.) This specification includes extensive requirements for pre-installation and post-installation testing and places on the contractor for installing systems having such attributes as water-tightness, low noise, puncture resistance, endurance to temperature extremes, long service under traffic, etc. In-service guarantee clauses holding the contractor liable for joint failure for a few years were judged to be unenforceable as a practical contractural obligation; nevertheless, suggested requirements and field tests are given for those highway agencies electing to include them. GRA

N80-12185# Transportation Research Board, Washington, D.C.
ADHESIVE MATERIALS, PAINTS AND CORROSION
Steven D. Hofener (Texas A. & M. Univ., College Station), David A. Law (Dept. of Transportation, N. Y. State), Gerald L. Anania (Dept. of Transportation, N. Y. State), W. R. Tooke, Jr. (Tooke Eng. Assoc., Atlanta), H. J. Fromm (Ontario Ministry of Transp. and Commun., Downsview), and A. M. Rosenberg (Grace, W. R., and Co., Columbia, Md.) 1978 47 p refs
(PB-298941/6; TRB/TRR-692; ISBN-0-309-02838-8; LC-79-17217) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418, HC $3.00 CSCL 13B

Papers in this report deal with the following areas: improving thermoplastic stripe adhesion on concrete pavements, acceptance sampling of structural paints; accelerated performance testing of bridge paints for seacoast environments; measurement of polarized potentials in concrete bridge decks; methods of determining corrosion susceptibility of steel in concrete; and measurement of cement content by using nuclear backscatter and absorption gauge. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N80-12186 Michigan Univ., Ann Arbor.
THEORETICAL DETERMINATION OF MINIMUM ENERGY REQUIRED FOR THE DIRECT INITIATION OF DETONATIONS Ph.D. Thesis
Rajshekhar Devendrarai Oza 1979 126 p
Avail: Univ. Microfilms Order No. 7925208

The determination of minimum energy for the direct initiation of a detonation in a planar, cylindrical or spherical cloud of a homogeneous gaseous combustible mixture is presented. It is assumed that the initial blast energy release E sub 0 is instantaneous in an infinitesimally small volume. The governing equations for the flow are one dimensional nonsteady equations without the transport effects. The oxyacetylene mixtures and the CH4 + 2O2 + xN2 mixtures were used to test the validity of the theory. The agreement between the theoretical prediction and the experimentally observed value for high values of the initiation energy is discussed. The value of the critical explosion radius for a given combustible mixture calculated using the present theory, is discussed in relation to both the cylindrical and the spherical geometries. Dissert. Abstr.

N80-12187 Pittsburgh Univ., Pa.
BURNING VELOCITIES OF A SOLID PROPELLANT, VIA A MICROWAVE TECHNIQUE, AT ELEVATED PRESSURES AND PRESSURIZATION RATES Ph.D. Thesis
Lisle Hoaglund Russell 1979 261 p
Avail: Univ. Microfilms Order No. 7924750

A research effort to directly measure, via a microwave Doppler/phase shift technique, the burning rate of solid propellant in both steady and dynamic elevated pressure environments is discussed. The recession velocity of the propellant when burned planarly within a small rectangular waveguide is examined in relation to the time rate of change of a measured relative phase angle. The relative phase angle was based upon the phase relationship between guided microwave reflections from two surfaces, one a reference plane and the other an effective plan created by the dielectric discontinuity at the burning propellant surface. In the attempt to extend the microwave technique to rapid pressurizations, a twin propellant strand differential system was constructed to isolate the propellant combustion response

from its mechanical response. The ability of the technique to cancel propellant mechanical responses was evaluated in a series of vibration or nonburning dynamic tests conducted at two distinctly different pressurization rates, slow and fast.
Dissert. Abstr.

N80-12188 Utah Univ., Salt Lake City.
ELUCIDATION OF COAL STRUCTURAL COMPONENTS BY SHORT RESIDENCE-TIME EXTRACTIVE LIQUEFACTION Ph.D. Thesis
Doonee Kang 1979 202 p
Avail: Univ. Microfilms Order No. 7925040

Short contact time thermal reactions of bituminous coals with tetralin in hydrogen atmosphere were studied to ascertain the nature of the reaction such as the mechanism of the coal liquefaction process, the labile functional structures in the coal and the products, the hydrogen transfer reactions between coal and tetralin, and the kinetics of coal conversion. Yield and kinetic data indicated reaction paths of the coal conversion. A hybrid kinetic model containg first and second order rate equations was developed and tested for the data. Dissert. Abstr.

N80-12189# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE FUTURE ROLE OF HYDROGEN FUEL IN AN ELECTRICAL SOCIETY
Gordon N. Patterson Oct. 1979 30 p refs
(UTIAS-241; CN-ISSN-0082-5255) Avail: NTIS HC A02/MF A01

The manufacture, storage, and use of hydrogen for peak-shaving purposes, vehicular power plants, and as a chemical raw material are discussed and programs for future development are indicated. It is concluded that plans for the future use of hydrogen on a large scale should be initiated now. M.M.M.

N80-12190# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
DYNAMIC MODEL OF WATER DELUGE SYSTEM FOR PROPELLANT FIRES
Joseph P. Caltagirone May 1979 21 p refs
(AD-A071457; AD-E400315; ARLCD-MR-78008) Avail: NTIS HC A02/MF A01 CSCL 19/1

Since the conventional water deluge system is ineffective in extinguishing propellant/explosive fires, a program was undertaken to develop a deluge system able to withstand the pressures involved in a propellant or explosive fire and to extinguish it before a detonation or extreme hazard occurs. Testing a full-scale water deluge system is costly; therefore, a model law was developed in order to test scaled-down systems. GRA

N80-12191# Texaco, Inc., El Monte, Calif. Montebello Research Lab.
GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION. EVALUATION OF SRC 2 VACUUM FLASH DRUM BOTTOMS FROM POWHATAN COAL AS A FEEDSTOCK FOR THE TEXACO GASIFICATION PROCESSES
A. M. Robin Mar. 1979 10 p
(Contract EX-76-C-01-2247)
(FE-2247-2) Avail: NTIS HC A02/MF A01

A 20 pound sample of vacuum flash drum bottoms, obtained from the liquefaction of Powhatan coal, was judged to be a suitable feedstock for a synthesis gas generation process. It can be charged directly to the gasifier at a temperature of about 615 F. The material is too viscous to be pumped with the pilot plant equipment, however, which is capable of maintaining a temperature of only 515 F. The addition of 3 to 5 percent cutter is required for the pilot plant tests. No cutter is required for a commercial plant. Based on these results, operating conditions and yields were estimated for gasifying 1000 pounds per hour of molten undiluted residue at 350 psig. A Type 2 preliminary pilot plant evaluation is planned. DOE

N80-12192# Babcock and Wilcox Co., Alliance, Ohio. Research Development Div.
CHARACTERIZATION AND COMBUSTION OF SRC 2 FUEL OIL Final Report
W. Downs and A. J. Kubasco Jun. 1979 131 p refs
(EPRI-FP-1028) Avail: NTIS HC A07/MF A01

An industrial boiler rated at a steam flow of 45,000 lbs/hr was used for combustion tests of solvent refined coal (SRC) fuel oil, No. 2 fuel oil, and No. 5 fuel oil. Operating variables included load, excess air, and burner register settings. The laboratory fuel analyses indicates that in most respects this SRC fuel oil sample behaved similarly to No. 2 fuel oil. The combustion test confirms that SRC fuel oil burns similarly to No. 2 fuel oil with one notable exception. NO/sub x/ emissions were substantially higher than for either the No. 2 or No. 5 fuel oils. The SRC fuel oil will require the application of NO/sub x/ combustion control techniques to meet the proposed New Source Performance Standards of 0.5 pound NO2/million Btu when burned in power boilers equipped with wall-mounted burners. DOE

N80-12193# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY Quarterly Report, 29 Sep. - 29 Dec. 1978
S. E. Scheppele 29 Jan. 1979 19 p refs
(Contract EX-76-S-01-2537)
(FE-2537-9) Avail: NTIS HC A02/MF A01

Field-ionization mass spectra, FI/MS, were obtained for the following saturate fractions: Anco Shale Concentrates, 200-325 C, 325-425 C, and 425 C +; South Swan Hills Concentrate 370-535 C; and Utah Crude Oil No. 72054. The molecular ion intensities in the FI/MS of each sample were converted into carbon number distributions as a function of Z(H). The weight percents across each Z(H) series were summed to obtain total weight percents as a function of saturate type. Steps in completing the interfacing of the Nova 3/12 data acquisition system to the comparator-microdensitometer are outlined and preliminary designs are given for the interface circuitry and the interface software. High- and low-resolution field-ionization mass spectral data were acquired for 19 monoaromatic, diaromatic, and polyaromatic polar concentrations. High-resolution field-ionization mass spectral data for the remaining asphaltene fractions from the COED coal liquid were acquired. DOE

N80-12194# California Univ., Livermore. Lawrence Livermore Lab.
SHOCK INITIATION AND DETONATION MODELS IN ONE AND TWO DIMENSIONS
S. G. Cochran and J. Chan 20 Jan. 1979 47 p refs
(Contract W-7405-eng-48)
(UCID-18024) Avail: NTIS HC A03/MF A01

A model for shock initiation and detonation of high explosives is presented. It has been implemented in one and two dimensional computer programs, KOVEC and Vector HEMP, respectively. The theory and implementation of the model are dicussed along with a description of its use. Applications of the model to two explosives, PBX-9404 and RX-03-BB, are presented. DOE

N80-12195# Alaska Dept. of Community and Regional Affairs, Kenai. Div. of Community Planning.
CHARACTERIZATION OF INITIATION AND DETONATION BY LAGRANGE GAGE TECHNOLOGY Final Report
N. Cowperthwaite and J. T. Rosenberg Dec. 1978 52 p refs
(Contract W-7405-eng-48; EY-76-C-03-115; SRI Proj. PYU-5611)
(UCRL-13976) Avail: NTIS HC A04/MF A01

Experimental and theoretical studies on the Lagrange gage and analysis techniques for determining constitutive relationships and energy release rates in shocked explosives were performed. Propositions were formulated for deducing hydrodynamic flow properties for a series of Lagrange pressure and particle velocity histories exhibiting maxima. These propositions were used to establish the phenomenology of the shock initiation process in PBX-9404 from the experimental pressure histories recorded at LLL. A Lagrange analysis was performed with the model solution to formulate and test methods for handling Lagrange gage records with pressure and particle velocity peaks similar to those exhibited by PBX-9404. DOE

N80-12196# Los Alamos Scientific Lab., N. Mex.
THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER, A CRITICAL REVIEW
K. E. Cox 1978 56 p refs Presented at USA/USSR Workshop on Alternative Uses of Fusion Energy, Moscow, 20 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2996; CONF-781178-1) Avail: NTIS HC A04/MF A01

The current status of thermochemical hydrogen technology as regards process chemistry, preliminary chemical engineering design, and techno-economics for a number of cycles undergoing active research and development efforts throughout the world at this time is assessed. Three cycles are receiving the bulk of the total effort and most of the funding: the hybrid sulfuric acid cycle; the sulfuric acid-hydrogen iodide cycle; and the hybrid sulfuric acid-hydrogen bromide cycle (Mark 13). All three cycles are at the stage where a laboratory scale continuous plant can be or is in operation. Improvements are being made in estimating the cost and efficiency of hydrogen produced from water and a thermal energy source either by thermochemical cycle technology or by water electrolysis. These include the heat penalty analysis and the OPTIMO computer code. Costs of thermochemical hydrogen have been found to fall in the $7 to $10/10 to the 16th power Btu range with efficiencies in the 35% to 45% bracket. DOE

N80-12197# Los Alamos Scientific Lab., N. Mex.
LASL THERMOCHEMICAL HYDROGEN PROGRAM STATUS ON OCTOBER 31, 1978
K. E. Cox and M. G. Bowman 31 Oct. 1978 9 p refs Presented at Chem. Hydrogen Energy Systems Contracts Rev., Washington, D.C., 28 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2895; CONF-781142-4) Avail: NTIS HC A02/MF A01

Progress is reported in developing an efficient and economical thermochemical cycle for the production of hydrogen from water utilizing thermal energy sources that become available. Topics covered include: (1) continuing experiments in sulfate decomposition, sulfate formation, and hydrogen iodide electrolysis; (2) fusion-synfuel study (hydrogen); and (3) evaluation of thermochemical cycles. DOE

N80-12198# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
CHARACTERIZATION OF COAL-DERIVED LIQUIDS AND OTHER FOSSIL FUEL RELATED MATERIALS EMPLOYING MASS SPECTROMETRY. MASS SPECTROMETRY AND FOSSIL-ENERGY CONVERSION TECHNOLOGY: A REVIEW
Quarterly Report, 30 Mar. - 29 Jun. 1978
S. E. Scheppele 1978 141 p
(FE-2537-7) Avail: NTIS HC A07/MF A01

The following activities in regard to the development of micromolecular probe distillation in combination with field-ionization mass spectrometry (FI/MS) for quantitative analysis are reported. The temperature-control module for the direct-introduction probe was received and successfully interfaced to both the probe and the NOVA 3/12. Both temperatures and FI/MS data were minicomputer acquired for probe distillation of a 19 component synthetic blend, an asphaltene-acid fraction, and the base fraction from an anthracene-oil sample. The acquired temperatures and FI/MS data for the 19 component blend were processed on the IBM 370/158 to obtain a quantitative distribution which is in excellent agreement with both the known composition and the one obtained from the FI/MS data acquired using the batch-inlet system for sample introduction. Development of algorithms for correlating the acquired temperatures with the acquired FI/MS data using the NOVA 3/12 and for preparing the correlated data for remote job entry to the IBM 370/158 were initiated. DOE

N80-12199# Institute of Gas Technology, Chicago, Ill.
STATUS OF THE PEATGAS PROCESS
D. V. Punwani 1978 30 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978
(Contract EX-76-C-01-2469)
(CONF-781045-3) Avail: NTIS HC A03/MF A01

PDU-scale tests were conducted to determine the effects of initial scale-up from the laboratory-scale equipment. The hydrogasification PDU represents a scale-up of about 250 times the laboratory-scale hydrogasifier. The tests in the laboratory-scale equipment were conducted with hydrogen and/or helium, whereas the tests in the PDU were conducted with hydrogen, steam-hydrogen, and synthesis gas. The PDU test results are in very good agreement with the results obtained in the laboratory-scale equipment. A mathematical model describing the kinetics was developed for the PEATGAS Process. A complete process design has been prepared for a preliminary base case for producing 250 x 10 to the ninth power Btu/day of SNG from the Minnesota peat (containing 50 percent moisture content). The plant thermal efficiency of this process is estimated to be 67 percent. Process economics for the completed base-case process design as well as several modified designs are evaluated. DOE

N80-12200# Institute of Gas Technology, Chicago, Ill.
HYGAS PROCESS UPDATE
W. G. Bair 1978 20 p refs Presented at Syn. Pipeline Gas Symp., Chicago, 30 Oct. 1978
(Contract EX-76-C-01-2434)
(CONF-781045-4) Avail: NTIS HC A02/MF A01

Nine tests with Illinois No. 6 Seam coal from the Peabody No. 10 mine were completed at 900 and 500 psig with char conversions reaching 90%, and sinter-free gasifier conditions were achieved at both pressure levels. Fines elutriation was studied and a method of identifying fines sources is being developed so that higher percentages of the char fed to the reactor can be gasified. In addition, the steam--oxygen distributor in the steam--oxygen gasifier zone of the reactor was successfully modified to improve the gasifier's ability to achieve high char conversions under sinter-free conditions. All of these activities and the data obtained through them contributed to improving the data base from which a successful commercial/demonstration plant can be designed. DOE

N80-12201# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL ASPECTS OF ALTERNATIVE FUELS UTILIZATION FOR HIGHWAY VEHICLES
C. J. Anderson 25 Oct. 1978 16 p refs Presented at Environ. Control Symp., Washington, D.C., 28 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81841; CONF-781109-22) Avail: NTIS HC A02/MF A01

Non-petroleum-derived transportation fuels being considered are derived from coal, oil shale, and biomass. The resultant synthetic liquid hydrocarbon fuels may or may not be identical to those derived from petroleum; the alcohols and hydrogen are certainly quite different. A number of environmental issues related to the alternative fuels utilization program are described as well as some of the various projects undertaken to resolve these issues. The accomplishments of these programs are emphasized (in some ways some of these fuels may be superior to existing fuels) and needs for further work are identified. DOE

N80-12202# Dynatech Corp., Cambridge, Mass.
COST ANALYSIS OF AQUATIC BIOMASS SYSTEMS
25 Jul. 1978 268 p refs
(Contract EG-77-C-01-4000)
(HCP/ET/4000-78/1) Avail: NTIS HC A12/MF A01

A cost analysis was conducted to provide the U.S. Department of Energy with engineering cost information on which to base decisions in the area of planning and executing research and development programs dealing with aquatic biomass as an alternative energy resource. Calculations show that several hundred 100 square mile aquatic biomass farms, the size selected for this analysis, would be needed to provide meaningful supplies of energy. It was found that the projections of costs for harvested open-ocean biomass, utilizing optimistic assumptions of scientific and engineering design parameters, appear to be above any practical costs to be considered for energy. One of the major limitations is due to the need to provide upwelled sub-surface water containing needed nutrients, for which pumping energy is required. It is concluded that large scale land-based aquatic biomass farms may merit development, but perhaps within a much narrower range than investigated. Aquatic plants which appear to have potential for development as an energy resource

are the so-called emersed plants, or angiosperms, including many types of freshwater weeds such as duckweed, Hydrilla, and water hyacinths. DOE

N80-12203# Department of Energy, Bartlesville, Okla.
COMPONENT RELATIONSHIPS WITHIN TWO-PHASE GASOLINE/METHANOL/WATER SYSTEMS
F. W. Cox Feb. 1979 52 p refs
(BETC/RI-78/6) Avail: NTIS HC A04/MF A01

Experimental data were derived from selected two-phase gasoline/methanol/water systems specifically to gain a better understanding of the phase relationships of these mixtures, to establish more firmly the severity of the phase-separation problem, and to devise a methodology applicable to future studies of gasoline/methanol blends for use as automotive fuels. Partition and mutual solubility relationships were then established from these data. The lower water-rich phase of a separated gasoline/methanol/water mixture is not usable as a fuel in current-production automobiles without engine adjustments. Generally speaking, increasing mixture temperature or adding the cosolvent, 1-hexanol, produces favorable equilibrium shifts for methanol and water by increasing their solubility in the upper gasoline-rich phase. Partition coefficient interrelationships offer a comparatively simple and reliable route to two-phase gasoline/methanol/water systems description. DOE

N80-12204# TRW, Inc., Redondo Beach, Calif.
ENVIRONMENTAL ASSESSMENT REPORT: LURGI COAL GASIFICATION SYSTEMS FOR SNG Final Report, May 1978 - Apr. 1979
M. Ghassemi, K. Crawford, and S. Quinlivan May 1979 344 p refs
(Contract EPA-68-02-2635)
(PB-298109/0; EPA-600/7-79-120) Avail: NTIS HC A15/MF A01 CSCL 21D

A compilation and analysis of data on the equipment and processes consituting the Lurgi Substitute Natural Gas (SNG) systems, the control/disposal alternatives for a media, the performance and cost of control alternatives, and present and proposed environmental requirements are presented. Data are provided on the characteristics of input materials, products, and waste streams associated with each process. Pollution control alternatives for air emissions, water effluents, solid wastes, and toxic substances in an integrated facility were examined for performance, costs, energy requirements, and ability to comply with current and anticipated environmental standards. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-12205 Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTIONS TO BALLISTICS, DETONATIONS, AND PULSE PHYSICS [BEITRAEGE ZUR BALLISTIK, DETONATIONS- UND KURZZEITPHYSIK]
1979 280 p refs Partly in GERMAN, ENGLISH and FRENCH
(BMVG-FBWT-79-01) Copyright. Avail: Issuing Activity

The following papers are presented: detonation of Nitromethane-Al-NO2 mixtures, use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile, miscellaneous topics in end ballistics, use of holography for kinetic energy measurements of target splinters, development of passive Doppler techniques in LRSL/ISL and their applications to ballistic and aerodynamic measurements, shock tube research to investigate the origin of Machwaves inside and outside supersonic jets, X-ray crystallographic analysis of the deformation of the crystalline structure of sodium chloride submitted to a shock wave compression, transient interactions of laser pulses with matter, experimental studies of laser induced detonation waves, and fanning spark discharges. For individual titles, see N80-12206 through N80-12215.

N80-12206 Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION OF NITROMETHANE-AL-NO2 MIXTURES c34
H. Moulard, C. Fauquignon, A. Lichtenberger, and J. M. Lombard *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 3-21 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

The internal and external detonation characteristics of nitromethane and aluminum powder mixtures were investigated. Nitrogen dioxide was added in order to vary the oxygen balance in the combustion reactions. The experimental results indicate the existence of a maximum detonation velocity in the vicinity of stochiometric compositions. A pressure drop associated with energy absorption due to the melting of the metal is also observed together with a subsequent progressive increase in pressure corresponding to the combustion of the metal. The kinetic energy released during the delayed aluminum combustion was determined from the expansion work of the reaction products. Author (ESA)

N80-12207 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HAMILTONIAN QUATERNIONS FOR DETERMINING THE TRANSLATIONAL AND ROTATIONAL MOTION OF A PROJECTILE c64
V. Fleck *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 22-35 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

Although Eulerian angles allow a good description of gyroscopic motion to be obtained, they are not the best fitted parameters for all problems. A system of differential equations is developed for determining the translational and rotational motion of a projectile with the aid of Hamiltonian quaternions. No singularities occur in the resulting system. An example is presented in which it is shown that the method proposed does not consume more computer time than the Eulerian method. Author (ESA)

N80-12208 Institut Franco-Allemand de Recherches, St. Louis (France).
MISCELLANEA CONCERNING TERMINAL BALLISTICS c37
G. Weihrauch, H. F. Lehr, and E. Wollmann *In its* Contrib. to Ballistics, Detonations, and Pulse Phys., 1979 p 36-110 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

Some terminal ballistic problems with kinetic energy penetrators are studied. Scaling rules, which permit the phenomena observed on a model to be transferred are examined. The dynamic compression of slender rods during impact on a rigid target is simulated numerically. A model is used in which the bar is treated as a linear chain of mass points. The dynamic plastic buckling of cylindrical projectiles is studied theoretically.
Author (ESA)

N80-12209 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HOLOGRAPHY FOR KINETIC ENERGY MEASUREMENTS OF TARGET SPLINTERS c35
H. Royer and M. Giraud *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 110-121 refs (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

The residual energy of high kinetic energy projectiles perforating armored targets is discussed. Two holograms are recorded at suitable times after the projectile impact. The image reconstruction of individual fragments from both holograms enables their velocities and three dimensional trajectories to be determined. The fragments collected are identified from their holographic images, and their kinetic energies are determined after weighing. Author (ESA)

N80-12210 Institut Franco-Allemand de Recherches, St. Louis (France).
THE DEVELOPMENT OF PASSIVE DOPPLER TECHNIQUES IN LRSL/ISL AND THEIR APPLICATIONS TO BALLISTIC

AND AERODYNAMIC MEASUREMENTS c35

B. Koch *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 122-166 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)

Copyright. Avail: Issuing Activity

A concise review of the historical and logical stages in the development of passive CW Doppler interferometer instrumentation for velocity and continuous space time measurements together with applications to ballistic and aerodynamic problems is presented. The extensive use of CW gas lasers, and their application in instruments such as the laser-Doppler-anemometer for aerodynamic flow research are discussed. Examples are given. Author (ESA)

N80-12211 Institut Franco-Allemand de Recherches, St. Louis (France).

SHOCK TUBE RESEARCH LOOKING AT THE ORIGIN OF THE MACHWAVES INSIDE AND OUTSIDE SUPERSONIC JETS c02

H. Oertel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 167-208 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)

Copyright. Avail: Issuing Activity

The kinematics and dynamics of Machwaves within the near field noise of supersonic jets were investigated. New optical techniques (system incorporating a differential interferometer), which revealed the existence of two families of regular Machwaves outside the jet together with two such families inside the jet, are described. The families accompany coherent structures of the jet boundary layer propagation downstream at three preferential speeds. These speeds are calculated with simple formulas. Shock compressions and shock distances measured using an optical microphone outside the jet are approximated by simple formulas. A suitable gas envelope which will suppress the Machwaves was confirmed experimentally. Author (ESA)

N80-12212 Institut Franco-Allemand de Recherches, St. Louis (France).

ANALYSIS OF THE STRUCTURE DEFORMATION OF SODIUM CHLORIDE SUBMITTED BY A SHOCK WAVE c76

F. Jamet and F. Bauer *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 209-226 refs In FRENCH; ENGLISH summary (For primary document see N80-12205 03-31)

Copyright. Avail: Issuing Activity

The experimental procedure used to obtain quantitative data on crystal deformation is described. Experiments in which molybdenum K alpha radiation was reflected from (200) lattice planes demonstrated that the deformation resulting from an incident plane wave is one dimensional for pressures exceeding the Hugoniot elastic limit (0.028 GPa in the (100) direction). It is thus concluded that the isotropic compression model is not suitable to explain behaviors observed with shock pressures in the 0.3 to 1 GPa range, where crystal behavior is plastic. Author (ESA)

N80-12213 Institut Franco-Allemand de Recherches, St. Louis (France).

TRANSIENT INTERACTIONS OF LASER PULSES WITH MATTER c36

K. Daree *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 227-241 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)

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Possible fusion energy application has incited work on laser generated plasmas. Discontinuous and arbitrary transient gasdynamic processes are discussed together with their applications to laser induced detonations. The mechanisms involved in this phenomenon are explained. The corresponding numerical calculation methods are presented. The pressure exerted on a target is shown to be highly dependent on the temporal shape of the laser pulse. The effects of different pressures, intensities, and pulse durations are investigated. The specific case of an aluminum target is studied. Author (ESA)

N80-12214 Institut Franco-Allemand de Recherches, St. Louis (France).

EXPERIMENTAL STUDIES OF LASER INDUCED DETONATION WAVES c36

M. Hugenschmidt and K. Vollrath *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 242-259 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)

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The interaction of CO2 laser pulses with metals (copper) is studied together with the resulting optically induced detonation waves (expansion properties, reflectivity and absorption). Measurements were performed at power densities up to 10 sup(9) W/sq cm in air under normal conditions and at reduced pressures as low as 0.1 torr. Cinematographically measured expansion versus time curves of waves and thermodynamic calculations were used to evaluate state parameters in the shock front. Initial pressures up to several kbars and internal specific energies of 10 sup(8) J/g were determined in this way. Author (ESA)

N80-12215 Institut Franco-Allemand de Recherches, St. Louis (France).

FANNING OF SPARK DISCHARGES c33

M. Schwertl and A. Stenzel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 260-268 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)

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High intensity, short pulse duration light sources have important applications in high-speed photography. A favorable ratio between these two parameters can be achieved by splitting a high current discharge into a large number of individual channels. Tests were carried out on radially symmetric and cylindrical discharges with various discharge condenser voltages and discharge conductivities. It was shown that fanned discharges enable photographs to be taken of high velocity objects (even in reflected light) with negligible blurring. Author (ESA)

N80-12216 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SPACE COMMUNICATIONS

Mar. 1979 321 p refs Proc. of Symp. on Advanced Satellite Commun. Sys., Genoa, 14-16 Dec. 1977 Original contains color illustrations

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The state of the art in space communications is presented. On-board message switching and signal processing, space antennas (such as Intelsat 5 spot beam antennas), and the more general subject of redundancy reduction in voice and video signals are among the top covered. For individual titles, see N80-12217 through N80-12235.

N80-12217 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

RELIABILITY PERFORMANCES OF SYSTEMS WITH A SWITCHING MATRIX c33

C. DallOlio *In its* Space Commun. Mar. 1979 p 21-58 refs Submitted for publication (For primary document see N80-12216 03-31)

(Contract ESTEC-2872/76/NL-AK(SC))

Copyright. Avail: Issuing Activity

A satellite model with an onboard switching matrix is examined in order to improve system reliability. An analytic method is used to predict the reliability of a satellite model with and without a switching matrix between receiving and transmitting equipment. It is concluded that the use of a switching matrix allows an increase in the complexity of transreceiving blocks and a reduction in the number of redundant units, which implies a mass and complexity reduction also for switching matrices on antenna ports. Author (ESA)

N80-12218 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

PERFORMANCE AND IMPAIRMENTS IN A QPSK SATELLITE TO GROUND LINK c32

P. Amadesi, L. Moreno, and M. SantAgostino *In its* Space Commun. Mar. 1979 p 59-107 refs Sponsored by ESA Submitted for publication (For primary document see N80-12216 03-31)

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The problems of satellite to ground transmission are discussed

with particular reference to factors that degrade the transmission quality. The use of four-phase coherent phase shift keying modulation with a very close spacing of the RF channels is assumed. The choice of the transmitter and receiver filters is examined in order to minimize the combined effects of intersymbol and adjacent channel interference. The effects of additional degradation factors are presented, including switching time of the RF modulator diodes, nonlinear behavior of the high power transmitter amplifier. A sample budget of the overall carrier-to-noise degradation is presented for typical satellite configurations. Author (ESA)

N80-12219 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
SYNCHRONIZATION PROCEDURES FOR A REGENERATIVE SS-TDMA SYSTEM c32
D. DiPino and R. Preti *In its* Space Commun. Mar. 1979 p 109-124 refs Submitted for publication (For primary document see N80-12216 03-31)
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A model of a regenerative, multi-spot, satellite-switched TDMA was developed in order to examine synchronization problems mainly caused by the nonapplicability of current low-level techniques (inhibited by a regenerative device) and the lack of transparency of the spatial segment in the network. The basic choices from which a self-consistent synchronization procedure can be derived are discussed, the functional structure of an onboard switching matrix is presented, and the functions to be performed both by the satellite and the ground station devices are indicated. It is shown that the synchronization problems related to an SS-TDMA can be solved more easily when employing a regenerative device for the repeaters. A synchronization method is described which eliminates the need of heavy data buffering. Author (ESA)

N80-12220 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
THE TELECOMMUNICATION SATELLITE AS AN INTEGRATED TIME DIVISION TRANSMISSION-SWITCHING SYSTEM c32
A. deFlammineis and A. Loffreda *In its* Space Commun. Mar. 1979 p 125-134 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
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The best exploitation of facilities offered by satellite communications and several operational modes are discussed. Facets of the system operation considered include reliability, feasibility, survivability, traffic characteristics, and adequacy to existing installations. Combinations of operational modes, such as preassigned modes with slowly patched or conditionally selected, or variable, or fully variable, destination circuits, can also result in convenient application, depending on local characteristics. It is also shown that the satellite system, being assimilated by an integrated time division transmitting-switching system adopted by different stations insisting on the same transponder, must have operational modes which are compatible with each other; signalling and burst reallocation procedures, in particular, must be the same. Author (ESA)

N80-12221 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
TRAFFIC SIMULATION IN A TELEPHONE NETWORK VIA SATELLITE WITH PREASSIGNED AND DEMAND ASSIGNED CIRCUITS c32
F. Manucci and A. Tonietta *In its* Space Commun. Mar. 1979 p 135-144 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
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An evaluation of statistical network performance was done by means of computerized simulation, analyzing the relative Markov chains in discrete time and comparing them with results of an analytical method based on a two-parameter traffic model. The application of both methods to a model with real dimension (network having two subsequent choices with preassigned first routing and fully variable alternate routing circuits) shows similar results, except for the call and time congestion encountered on access terrestrial links. These discrepancies are interpreted as lack of accuracy displayed by the analytic method. Author (ESA)

N80-12222 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN APPROACH TO BLOCKED APERTURE SYNTHESIS c32
P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 183-186 refs Presented at European 77, Venice, May 1977 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

Various aspects of blockage effects on the performance of Cassegrain antennas are discussed. Very simple expressions found for calculating the influence of the blocked parts on the antenna efficiency with respect to the aperture illumination functions are given. The behavior of the side lobe levels versus the struts and subreflector dimensions appears from several plots. The reported results make it possible to synthesize, using only a desk-top computer, a ground station Cassegrain antenna which has the characteristics of having the blocked aperture efficiency as high as possible and the first lobe levels bounded within fixed values. Author (ESA)

N80-12223 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ANALYSIS AND SYNTHESIS OF CORRUGATED CONICAL HORNS c32
P. Bielli, Salvatore DePadova, and E. Pagana *In its* Space Commun. Mar. 1979 p 195-200 refs Presented at 6th European Microwave Conf., Rome, Sep. 1976 (For primary document see N80-12216 03-31)
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The characteristics of corrugated conical horns, radiating the balanced hybrid mode HE11 are summarized in a number of linear curves giving the beam width at different levels versus the horn flare angle and versus the radius of the horn aperture, normalized to the wavelength. Moreover, the feed horn performance for single or double reflector antennas is analyzed and curves are presented for the antenna illumination efficiency (aperture efficiency by spillover efficiency) versus other parameters. All the curves reported are useful basis for antenna design and give a fast and accurate solution to the problem of synthesis of a corrugated conical horn with a specified amplitude radiation pattern and synthesis of a corrugated conical horn as a function of the antenna illumination efficiency. Author (ESA)

N80-12224 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
A METHOD FOR COMPUTING CORRUGATED HORNS PHASE CENTER c32
P. Bielli, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 201-206 refs (For primary document see N80-12216 03-31)
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Corrugated feed horns are often required to offer a phase radiation pattern as flat as possible within the feeding angle subtended by the reflector edge. A method for phase-center computation was developed which complies with this requirement. The phase center and the phase radiation patterns obtained were compared with experimental measurements. Variations of phase-center positions with horn geometrical parameters, observation distance, and wavelength are plotted for several corrugated horns which can be considered as typical feeds for Cassegrain antennas. Author (ESA)

N80-12225 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ANALYSIS AND SYNTHESIS OF AN ELLIPTICAL PARABOLOID OFFSET REFLECTOR ANTENNA. AN ELLIPTICALLY SHAPED BEAM ANTENNA c32
Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 207-210 refs Repr. from Antennas and Propagation, 15-19 May 1978 p 381 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

A method to design an elliptically shaped beam antenna

characterized by a particular type of reflector is presented. The main advantages of such a configuration are an easier mechanical realization; the possibility of varying the main beam cross section for a given feed system by simply operating on the range of variation of the reflector foci; a simplification in the reflector design due to the feasibility offered by a graphical and analytical representation of the relationship between the main beam ellipticity and the paraboloid ellipticity; and the possibility of designing multibeam antennas characterized by different given ellipticities for each beam. Author (ESA)

N80-12226 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYTICAL AND GRAPHICAL METHODS FOR THE DESIGN OF AN ELLIPTICALLY SHAPED BEAM ANTENNA WITH ELLIPTICAL PARABOLOID REFLECTOR c32

Salvatore DePadova, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 211-215 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)

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A study of an antenna having an elliptically shaped main beam is presented. The geometry of the reflector has led to the antenna being called an elliptical paraboloid reflector antenna. The reported results refer to the offset configuration. General graphical or analytical laws to simplify a first approximation synthesis of this antenna are discussed. Curves of the efficiency, ellipticity, and cross levels versus a normalized variable are plotted. This variable is strictly related to the maximum phase error on the aperture edge. Author (ESA)

N80-12227 Centro Studi e Laboratori Telecdmunicazioni, Turin (Italy).

AN ELLIPTICALLY SHAPED BEAM ANTENNA c32

Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 229-234 refs Presented at European Microwave Conf., Paris, Sep. 1978 (For primary document see N80-12216 03-31)

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A reflector antenna having a shaped main beam with elliptical cross section was developed in order to save power and avoid interference in satellite communications. In many cases an elliptical contour is required. Often the methods used to design a shaped main beam antenna are based on the geometrical optics theory which, as known, is not completely valid at microwave frequencies. An extensive analysis of an elliptically shaped beam antenna is reported. The peculiarity of this antenna is the shape of the reflector which is an elliptical paraboloid. The geometry of the reflector has led to the antenna being called an 'elliptical paraboloid reflector antenna'. For this antenna general curves are presented which allow a very fast and accurate design.

Author (ESA)

N80-12228 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

REFLECTOR ANTENNAS WITH HIGH EFFICIENCY AND LOW DEPOLARIZATION c32

P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 235-238 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)

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Compensation of the feed cross polar fields by means of the whole reflecting surface was carried out by making the integral of the elements which give the cross polar pattern zero. Then the set of feed and reflector parameters were optimized. The cross polarization due to the feed cancelled the cross polarization due to the reflector curvature. Several feed horns were considered and a comparison is made on the basis of antenna efficiency, depolarization, and bandwidth. Author (ESA)

N80-12229 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SOME CONSIDERATIONS ABOUT SKY NOISE TEMPERATURE AT FREQUENCIES ABOVE 10GHz c32

E. D. Damasso and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 239-247 refs Repr. from Alta Frequenza, v. 65, no. 2, 1976 p 98-10E-106-18E (For primary document see N80-12216 03-31)

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Estimation criteria of sky noise temperature as related to elevation angle are presented for frequencies between 11 and 18 GHz. In particular, in the case of clear sky conditions, some relationships for estimating noise temperature as related to elevation angle are given in which only the knowledge of ground absolute humidity is required. The noise contribution due to atmospheric precipitation is computed from rain attenuation and corresponding kinetic temperature knowledge (between 260 and 280 K). Procedures to evaluate the angular dependence of the attenuation exceeded for time percentage of 0.17 or 0.01% (on a yearly basis) are given. Attenuation values can be obtained for a given elevation angle if the attenuation at other angles is known. Author (ESA)

N80-12230 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

BIT RATE REDUCTION BY AUTOMATIC ADAPTATION OF QUANTIZER STEP-SIZE IN DPCM SYSTEMS c32

Paolo Castellino, Giulio Modena, Luciano Nebbia, and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 257-263 refs Repr. from CSELT Rappt. Tec., no. 2, Sep. 1974 (For primary document see N80-12216 03-31)

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A Differential Pulse Code Modulation (DPCM) system with adaptative quantization is described. Theoretical considerations on the optimum parameters that determine the quantizer adaptation in order to minimize the quantizing noise are developed. The performances of a 32 kbit/sec computer simulation of such a system are shown and the particular type of output quantizing noise examined. Attention is devoted to subjective evaluation of the output quality, even in the presence of channel errors. It is concluded that the DPCM system, at a 32 kbit/sec rate is subjectively comparable with a 64 kbit/sec log-PCM system for the whole range of real telephone speech signals. Author (ESA)

N80-12231 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN ADAPTIVE QUANTIZER WITH CHANNEL ERROR RECOVERY c32

Carlo Scagliola *In its* Space Commun. Mar. 1979 p 265-272 refs Repr. from CSELT Rappt. Tec., no. 4, Dec. 1976 (For primary document see N80-12216 03-31)

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Adaptation schemes of the quantizer characteristic in digital transmission of signals were proposed in which the range scale of the quantizer is controlled by the output codeword sequence so that the relevant information does not need to be transmitted. These schemes are, however, sensitive to channel errors; in fact, a transmission error may cause a multiplicative offset between the level at the receiver and at the transmitter, which in theory, will never be recovered. In order to eliminate this effect an adaptation algorithm of the quantizer step-size was developed which is robust to channel errors in that their effect diminishes with time. After a description of the algorithm, with a proof of the convergence to zero of the deviation between the levels at the receiver and at the transmitter, system performance in terms of signal-to-noise ratio are evaluated as a function of the input level in an error-free situation. In the last section a numerical evaluation of the time needed by the system to forget the effect of the errors is carried out. Author (ESA)

N80-12232 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

DESIGN OF INSTANTANEOUSLY COMPANDED DELTA MODULATORS WITH M-BIT MEMORY c33

Paolo Castellino and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 273-276 refs Presented at IEEE Intern. Conf. on Acoustics, Speech and Signal Process, 1977 (For primary document see N80-12216 03-31)

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Starting from simple observations on ideal waveform tracking, a learning algorithm is given, which permits the calculation of values of the multipliers for any bit sequence length which are tailored to the statistical properties of the signal used in the learning stage. This algorithm automatically takes into account

even the particular predictor used in the delta feedback loop. The multiplier design is exploited for speech signals in various circuit conditions such as clock rate, predictor complexity and length of the bit sequence. The modulator performances are evaluated also as a function of the input signal level.
Author (ESA)

N80-12233 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
EVALUATION OF ADAPTIVE SPEECH CODERS UNDER NOISY CHANNEL CONDITIONS c32
Carlo Scagliola *In its* Space Commun. Mar. 1979 p 277-281 refs Repr. from ICC Conf. Record, v. 1, 4-7 Jun. 1978 p 8.1.1-8.1.5 (For primary document see N80-12216 03-31)
(Contract CH1350-8/78/0000-0037)
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The results of an experiment in which the digital transmission of speech coded by adaptive differential pulse code modulation was simulated under noisy channel conditions are presented. Subjective quality judgements and a number of objective performance measures were collected. The influence of various design parameters on speech quality under noisy channel conditions is discussed. Overall subjective quality is well predicted by the combination of an objective performance measure that disregards any effect of level mismatching due to the sensitivity of the adaptation algorithm to channel errors and a measure of the level mismatching itself. The best prediction scores are achieved by three objective performance measures: two level-compensated signal to noise ratios and a spectral signal to distortion ratio. Author (ESA)

N80-12234 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN ADAPTIVE DELTA MODULATOR ROBUST TO TRANSMISSION ERRORS c32
Paolo Castellino *In its* Space Commun. Mar. 1979 p 283-287 refs Presented at 4th Intern. Conf. on Digital Satellite Commun., Montreal, Oct. 1978 (For primary document see N80-12216 03-31)
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A technique is described suitable to make a fully digital adaptive delta modulator robust to channel error rates even higher than those of a satellite link. It is shown that the addition of a bias term into the adaptation algorithm makes the two step-sizes at the transmitter and at the receiver converge after a channel error. The step-size adapter parameters are obtained by a compromise between the convergence time and the idle-channel; in fact both are increasing funtions of the bias term. Results of simulations at 32 kbit/sec are given in terms of signal to noise ratio. The halving time of the relative deviation between the transmitter and receiver step-sizes is given as an index of the validity of the algorithm. Finally the error recovery time is defined and experimentally measured. Author (ESA)

N80-12235 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
TRANSFORM CODING OF PAL COMPOSITE SIGNALS c32
L. Chiariglione, M. Guglielmo, and Sciarappa *In its* Space Commun. Mar. 1979 p 289-312 refs Submitted for publication (For primary document see N80-12216 03-31)
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Investigations were carried out on the coding of PAL composite signals. The analog signal is sampled at a frequency just above Nyquist's, which can be derived in an easy way from the fundamental frequencies of the PAL system and is such as to ensure the formation of an orderly grating of sampler. The statistical properties of the sampled signal were derived and suitable transformations well matched to the signal statistics were employed. The differential pulse code modulation coding on the DFT coefficients of line blocks was investigated and a prediction algorithm was developed which can be applied on temporally successive lines. Two and three dimensional block transformations were also considered with artifices to lessen block visibility at low numbers of bits/pel. Author (ESA)

N80-12236# California Inst. of Tech., Pasadena.
LEADING EDGE FLUTTER OF SUPERCAVITATING HYDROFOILS Final Report
C. Brennen, K. Oey, and C. D. Babcock May 1979 85 p refs (Contract N00014-75-C-0379; SR0230101)
(AD-A073382; ENG-216-1) Avail: NTIS HC A05/MF A01 CSCL 13/10

This document represents the results of experiments and analysis of the phenomenon of leading edge flutter which has been observed to occur for supercavitating hydrofoils. The experiments confirmed the existence of such a single degree of freedom flutter involving chordwise bending and indicated that for long, natural (or vapor-filled) cavities the reduced flutter speed U sub F/omega sub FC was in the range 0.15 to 0.23. Secondary effects observed were the variation with the angle of attached (a minimum flutter speed occurred at 10 deg) and with a foil mass ratio. Shorter cavities typically yielded lower flutter speeds due to a complex interaction between the bubble collapse process occurring in the cavity closure region and the unsteady hydrodynamic load on the foil. Finally, a relatively simple theoretical analysis for supercavitating hydrofoils with elastic axes aft of mid-chord is presented. This linear analysis yields reduced flutter velocities somewhat lower than those observed. GRA

N80-12237# Sydney Univ. (Australia). Civil Engineering Labs.
REINFORCEMENT TO CONTROL THERMAL AND SHRINKAGE CRACKING
D. Campbell-Allen and G. W. Hughes Nov. 1978 37 p refs (PB-298412/8; R-334) Avail: NTIS HC A03/MF A01 CSCL 13C

A theory was developed based on the 'bond-slip' mechanism to calculate the quantity of reinforcement required to satisfactorily distribute thermal and shrinkage cracking. A study of published experimental results and field measurements and the results of a laboratory test program confirm that this theory is a reasonable description of observed cracking behavior. A survey of the provisions of current design codes shows that the quantity of shrinkage and temperature reinforcement, currently specified, is totally inadequate for the range of thermal and shrinkage strains normally experienced in Australia. A method of calculating the required quantity of reinforcement is expressed in a format suitable for inclusion in a design code. GRA

N80-12238# Sydney Univ. (Australia).
RECENT CONCEPTS: THEIR INFLUENCE ON CODE PREDICTIONS OF SHRINKAGE AND CREEP
H. Roper and G. Bott Apr. 1979 29 p refs
(PB-298413/6; R-343) Avail: NTIS HC A03/MF A01 CSCL 13C

The mechanisms of creep and shrinkage of concrete, in particular activation energy and the rate of flow concepts as applied to creep, are studied. Creep predictions using various codes (AS1481, NAASRA, CEB-FIP 1970 and 1978) are compared with Australian data. The derivation of the code values is discussed and it is recommended that improvements to the AS1481 predictions for creep be considered. GRA

N80-12239# Sydney Univ. (Australia). Civil Engineering Labs.
THE EFFECTS OF FREESTREAM TURBULENCE ON THE GALLOPING BEHAVIOUR OF A SQUARE TOWER
K. C. S. Kwok and W. H. Melbourne Dec. 1978 43 p refs (PB-298744/4; R-338) Avail: NTIS HC A03/MF A01 CSCL 13M

It is also shown that the fine scale turbulence produced by a thin rod upstream of the stagnation streamline of the tower is sufficient to increase turbulence mixing in the separated shear layers, increase the rate of entrainment from the wake, and decrease the radius of curvature of the shear layers. These effects significantly alter the transverse force characteristic and hence the galloping behavior of the tower. GRA

N80-12240# Rensselaer Polytechnic Inst., Troy, N. Y.
SEISMIC VULNERABILITY, BEHAVIOR AND DESIGN OF BURIED PIPELINES, PHASE 1 Final Report
Leon Ru-Liang Wang, Michael J. ORourke, and Richard R. Pikul Mar. 1979 148 p refs
(Grants NSF PFR-76-14884; NSF ENV-76-14884)
(PB-298269/2; NSF/RA-790093; TR-9) Avail: NTIS

HC A07/MF A01 CSCL 13K

The seismic damage and response behavior of general buried pipelines is presented and vulnerability evaluation and design criterion of buried simple piping systems are described. The investigation focuses on the simplified analysis' and quasi static analysis' approaches for determining the axial strains and relative joint displacements and rotations due to seismic shaking. To verify the assumptions and limitations in the analyses, the ground motion characteristics of the San Fernando earthquake and related soil parameters are studied in detail. To evaluate the seismic vulnerability design of simple buried piping systems, a seismic risk analysis using data for Albany, New York is performed, and a failure criterion for buried water pipes is proposed. GRA

N80-12241# California Univ., Richmond. Earthquake Engineering Research Center.

A MATHEMATICAL MODEL OF MASONRY FOR PREDICTING ITS LINEAR SEISMIC RESPONSE CHARACTERISTICS

Yalcin Mengi and Hugh D. McNiven Feb. 1979 115 p refs (Grants NSF ENV-76-04265; NATO-1446)

(PB-298266/8; UCB/EERC-79/04; NSF/RA-790069) Avail: NTIS HC A06/MF A01 CSCL 13M

A mathematical model for masonry was developed which can be used to derive the elastic stress field, in a wall or pier, when either is subjected to seismic loads. Because masonry is made of two materials, and because its geometry is so complicated, it was necessary, in studying stress fields that could arise, to replace the composite material by a homogeneous one. The model was appraised by comparing the responses predicted by the model for a transient input with those observed experimentally. GRA

N80-12242# National Bureau of Standards, Washington, D.C.

DIMENSIONS/NBS, VOLUME 63, NO. 7/8 Monthly Report, Jul. - Aug. 1979

Aug. 1979 33 p

(PB-298372/4; NBS-DIM-63-7-8) Avail: NTIS HC A03/MF A01 CSCL 14B

Summaries of major technical developments and highlights of work in progress are presented along with a listing of current publications. GRA

N80-12243# California Univ., Richmond. Earthquake Engineering Research Center.

ANALYTICAL PROCEDURES IN SOIL DYNAMICS

John Lysmer Dec. 1978 101 p refs Presented at the ASCE Geotechnical Eng. Div. Specialty Conf. on Earthquake Eng. and Soil Dyn., Pasadena, Calif. 19-21 Jun. 1978

(PB-298445/8; UCB/EERC-78/29) Avail: NTIS HC A06/MF A01 CSCL 08M

The state-of-the-art of soil dynamics analysis is reviewed. A classification system is suggested for soil dynamics response problems and a discussion is given of current abilities and future possibilities for solving different types of problems. Special attention is given to the possibilities for nonlinear and effective stress analysis of seismic problems. Major topics discussed are: foundation vibrations, pile vibrations, seismic site response problems, and soil-structure interaction. GRA

N80-12244# Transportation Research Board, Washington, D.C.

STABILIZATION AND COMPACTION

L. Raad (Illinois University -Urbana), C. L. Monismith (Calif. Univ., Berkeley), J. K. Mitchell (Calif. Univ., Berkeley), R. M. Quigley (University of Western Ontario, London), L. R. DiNardo (University of Western Ontario, London), Alfreds R. Jumikis (Rutgers Univ., New Brunswick, N. J.), Dirk J. A. vanZyl (Purdue Univ.), L. E. Wood (Purdue Univ.), C. W. Lovell (Purdue Univ.), and W. J. Siciliano (Indiana State Highway Comm.) 1978 44 p refs

(PB-298935/8; TRB/TRR-690; ISBN-0-309-02836-1; LC-79-17962) Avail: NTIS HC A03/MF A01 CSCL 13B

Seven papers are presented which deal with the following areas: crack propagation in soil-cement bases subjected to repeated wheel loads; clay mineral weathering controls on lime and cement stabilization of southwestern Ontario clay borrow (abridgment); pressure-grouted soil anchors; storge, retrieval, and analysis of compacted shale data; the use of indicative properties to predict the density-moisture relationship of soils; specifying soil compaction; and base-course gravel compaction control by the comprimeter. GRA

N80-12245# Transportation Research Board, Washington, D.C.

RELATIONSHIP OF ASPHALT CEMENT PROPERTIES TO PAVEMENT DURABILITY Final Report

Jun. 1979 51 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials

(PB-298833/5; TRB/NCHRP/SYN-59; ISBN-0-309-02911-2; LC-79-65727; ISSN-0547-5570) Avail: NTIS MF A01; HC $5.60, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Detailed information is presented on how various properties of asphalt cement influence pavement performance. In recent years, apparent changes have evolved in the physical properties of asphalt cements used in pavement construction. Some of these properties are not controlled or are controlled only partially by AASHTO specifications. All available information is reviewed relating durability and performance of asphaltic concrete mixtures to the properties of asphalt cement. Recommendations for improved test procedures and criteria are included. It is concluded that hardness of the asphalt is the property most important to pavement performance. GRA

N80-12246# Transportation Research Board, Washington, D.C.

FAILURE AND REPAIR OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT Final Report

Jul. 1979 50 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials

(PB-298832/7; TRB/NCHRP/SYN-60; ISBN-0-309-02913-9; LC-79-66364; ISSN-0547-5570) Avail: NTIS MF A01; HC $5.60, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418 CSCL 13B

Detailed information is presented on maintenance and repair techniques currently used for continuously reinforced concrete pavement (CRCP). The performance of CRCP has revealed a number of failure modes that are traceable to design, construction, materials, and maintenance deficiencies and such other factors as environmental conditions and traffic loadings. A review of the cumulative experiences of states that have constructed and maintained CRCP is included. Guidelines for repair techniques are included, and areas of needed research are identified. GRA

N80-12247# Transportation Research Board, Washington, D.C.

DURABILITY OF CONCRETE BRIDGE DECKS Final Report

May 1979 69 p refs Sponsored in part by Federal Highway Administration and American Association of State Highway and Transportation Officials

(PB-298829/3; TRB/NCHRP/SYN-57; LC-79-64881; ISSN-0547-5570) Avail: NTIS MF A01; HC $6.00, Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Detailed information is presented on the causes, prevention, evaluation, and rehabilitation of deck deterioration related to corrosion of steel reinforcement. It was reported in 1978 that nearly one-third of all highway bridge decks in the United States are seriously deteriorated due to corrosion of reinforcing steel. The cost of restoring these decks has been estimated at $6.3 billion. Virtually all protective systems currently in use to prevent corrosion of bridge deck reinforcing steel were developed following publication of Synthesis 4. In addition, methods of evaluation and rehabilitation have changed significantly since then. The current synthesis is, therefore, intended to supplement the earlier effort. The design and construction techniques currently in use to prevent deterioration of new bridge decks and also the evaluation and rehabilitation techniques in use to extend the service life of existing decks are reviewed. Recommendations are included for research needs related to bridge deck durability. GRA

N80-12248# Sydney Univ. (Australia).

LARGE DEFLECTION ANALYSIS OF PORTAL FRAMES

R. Q. Bridge Oct. 1978 25 p refs

(PB-298741/0; R-331) Avail: NTIS HC A02/MF A01 CSCL 13B

A numerical method is described for the second order, in-plane analysis of portal-type, steel, industrial frames accounting for both non-linear geometrical and material responses. Although primarily designed for determining the ultimate strength of frames, the same method can be used to predict the critical elastic frame buckling loads for any axial load configuration. Comparisons with results from tests on frames have confirmed the accuracy of the method. The method is well suited to minicomputer application as it is simple and makes no great demands on storage, the most complex operation being the inversion of 3x3 array. GRA

N80-12249# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
PERFORMANCE OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT IN ILLINOIS: Interim Report, 1976 - 1977
Scott A. LaCourisere, Michael I. Darter, and Scott A. Smiley Dec. 1978 149 p Sponsored in part by Ill. State Dept. of Transportation, Springfield
(PB-298495/3; UIUC/ENG-77-2018; TE-Ser-20; FHWA/IL/UI-172) Avail: NTIS HC A07/MF A01 CSCL 13B

A study of the performance of continuously reinforced concrete pavement (CRCP) constructed on the interstate highway system in Illinois was conducted. The types, severities, amounts, and causes of distress were determined. Distress found included edge punchouts, steel ruptures, 'D' cracking, blowups, construction joint failures, lug rotation, longitudinal cracking, distress related to construction problems, pumping, and shoulder deterioration. Heavy truck loads, excess free moisture, deicing salts, construction practice and poor aggregate quality in the CRCP slab were the major factors causing distress. GRA

N80-12250# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
PERFORMANCE OF BURIED FLEXIBLE CONDUITS Interim Report
G. A. Leonards and R. A. Stetkar 12 Dec. 1978 111 p refs Sponsored in part by Ind. State Highway Commission, Indianapolis
(PB-298224/7; JHRP-78-24; FHWA/RD-79-S0873) Avail: NTIS HC A06/MF A01 CSCL 13B

An extensive review was made of the performance of buried flexible culverts, with special emphasis on buckling failure modes. All known theories on elastic buckling of rings and cylinders with radial support subjected to external radial pressures were analyzed and compared with each other, and with the results of controlled experiments on small and full-scale culverts. Some relevant field measurements were also investigated. The significant results are presented. GRA

N80-12251# Kansas Dept. of Transportation, Topeka. Planning and Development Dept.
AN EVAPO-TRANSMISSION METHOD FOR DETERMINING RELATIVE PERMEABILITY OF CONCRETE Interim Report, Jan. 1976 - Mar. 1979
Garrett L. Morrison, William J. Gilliland, John E. Bukovatz, G. P. Jayaprakash, and Richard D. Seitz Apr. 1979 43 p refs
(PB-298323/7; FHWA/KS-79/1) Avail: NTIS HC A03/MF A01 CSCL 13C

A simple and inexpensive procedure was developed to determine the 'relative permeability' of concrete. A capillary tube was attached to a wet cell to measure drawdown. Both the capillary and the wet cell were filled with distilled water. A desiccant, anhydrous magnesium perchlorate, is put in the dry cell to provide 0% relative humidity. Differences in relative humidity between sides of the test sample provided the driving force for water or water vapor movement. Under the influence of this force, water was transmitted through the test slab from the wet side toward the dry side where it evaporates. 'Evapo-transmission' was measured instead of true permeability. GRA

N80-12252# National Bureau of Standards, Washington, D.C. Office of Nondestructive Evaluation.
A COMPARISON OF AMERICAN AND EUROPEAN ULTRASONIC TESTING STANDARDS
Sam Golan Aug. 1979 74 p refs
(PB-298809/5; NBSIR-79-1790) Avail: NTIS HC A04/MF A01 CSCL 14B

The twenty-seven general ultrasonic standards from eleven countries and international organizations were reviewed. Thirty-seven ultrasonic product standards from five countries were studied to evaluate the utilization of the general ultrasonic standards, i.e., to what the procedures outlined in the general standards are applied by the product standards. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-12253 Carnegie-Mellon Univ., Pittsburgh, Pa.
GUIDED WAVE ACOUSTOOPTIC DEVICES FOR WIDEBAND REAL-TIME SIGNAL PROCESSING Ph.D. Thesis
Iwen Yao 1979 207 p
Avail: Univ. Microfilms Order No. 7919160

Two guided wave acoustooptic devices for wideband real-time signal processing along with a wideband anisotropic acoustooptic Bragg deflector in Y-cut Ti-diffused $LiNbO_3$ waveguides are presented. In addition to the inherent wide bandwidth capability, these acoustooptic devices possess following novel features: (1) low cost, (2) light weight, (3) rugged structure, (4) low power consumption, and (5) optics aligned during the fabrication process. An overview on the fabrication techniques for optical waveguides and the guided wave modes in these waveguides is first presented, followed by an analysis of surface acoustic wave propagation and guided wave acoustooptic Bragg interaction. A description of the design and fabrication of interdigital transducers and the study of optimized guided wave anisotropic acoustooptic Bragg diffraction are presented. Dissert. Abstr.

N80-12254 State Univ. of New York at Albany.
ELECTROMAGNETIC INTERACTIONS IN RELATIVISTIC INFINITE COMPONENT WAVE EQUATIONS Ph.D. Thesis
Christopher Clayton Gerry 1979 155 p
Avail: Univ. Microfilms Order No. 7925078

A way of making a minimal relativistic generalization of the minimal interactions in the nonrelativistic equation for the hydrogen atom is proposed. In order to calculate the effects of the relativistic minimal interactions so introduced, a covariant perturbation theory suitable for infinite component wave equations, which is an algebraic and relativistic version of the Rayleigh-Schroedinger perturbation theory was developed. By utilizing the developed perturbation technique, the electric and magnetic polarizabilities for the ground state of the hydrogen atom were calculated. It was shown that the results do have the correct nonrelativistic limits. The problem of interactions with a radiation field were considered. Directly applying the S-matrix formalism in field theory to the infinite component theoretic treatment of the interactions, the relativistic cross section of photon absorption by the atom was evaluated. Dissert. Abstr.

N80-12255*# Arinc Research Corp., Annapolis, Md.
CONTROL OF ELT FALSE ALARMS Final Report
S. Toth and I. Gershkoff Oct. 1979 110 p refs
(Contract NASw-3229)
(NASA-CR-162502; Publ-1362-01-1-2032) Avail: NTIS HC A06/MF A01 CSCL 17B

The statistics of emergency locator transmitter (ELT) alarms are presented. The primary sources of data include ELT Incident Logs, Service Difficulty Reports, and Frequency Interference Reports. The number of reported and unreported alarms is discussed, as are seasonal variations, duration of ELT transmissions, and cost of silencing. Origin, causes, and possible strategies for reducing the impact of alarms on the aviation community are considered. A.R.H.

N80-12256*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD FOR SHAPING AND AIMING NARROW BEAMS Patent Application

Richard C. Heyser, inventor (to NASA) (JPL) Filed 7 Nov. 1979 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14832-1; US-Patent-Appl-SN-092143) Avail: NTIS HC A02/MF A01 CSCL 20N

A method and apparatus is disclosed for use of a linear frequency chirp in a transmitter/receiver having a correlator to synthesize a narrow beamwidth pattern from otherwise broad beam transducers when there is relative velocity between the transmitter/receiver and the target. The chirp is so produced in a generator in bandwidth, B, and time, T, as to produce a time-bandwidth product, TB, that is increased for a narrower angle. A replica of the chirp produced in a generator is time delayed and Doppler shifted for use as a reference in receiver for correlation of received chirps from targets. This reference is Doppler shifted to select targets preferentially, thereby to not only synthesize a narrow beam but also aim the beam in azimuth and elevation. NASA

N80-12257*# Mitre Corp., Houston, Tex.
CENTRAL COMPUTATIONAL FACILITY CCF COMMUNICATIONS SUBSYSTEM OPTIONS
K. B. Hennigan Jun. 1979 129 p
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160383; MTR-4728; JSC-16006) Avail: NTIS HC A07/MF A01 CSCL 17B

A MITRE study which investigated the communication options available to support both the remaining Central Computational Facility (CCF) computer systems and the proposed U1108 replacements is presented. The facilities utilized to link the remote user terminals with the CCF were analyzed and guidelines to provide more efficient communications were established. M.M.M.

N80-12258*# Mitre Corp., Houston, Tex.
THE NASA BUS COMMUNICATIONS LISTENING DEVICE SOFTWARE
M. A. Allen Jul. 1979 73 p refs
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160384; MTR-4729; JSC-16054) Avail: NTIS HC A04/MF A01 CSCL 17B

The development of the bus listener is presented. Special software was developed to control the 'bus interface units' (BIU) connecting each of these devices to a communications cable to form the bus communication network. The code used in the BTU is described. Author

N80-12259*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.
LOW SIDELOBE LEVEL LOW-COST EARTH STATION ANTENNAS FOR THE 12 GHz BROADCASTING SATELLITE SERVICE
R. E. Collin and L. R. Gabel Sep. 1979 117 p refs
(Contract NAS3-21365)
(NASA-CR-159703) Avail: NTIS HC A06/MF A01 CSCL 17B

An experimental investigation of the performance of 1.22 m and 1.83 m diameter paraboloid antennas with an f/D ratio of 0.38 and using a feed developed by Kumar is reported. It is found that sidelobes below 30 dB can be obtained only if the paraboloids are relatively free of surface errors. A theoretical analysis of clam shell distortion shows that this is a limiting factor in achieving low sidelobe levels with many commercially available low cost paraboloids. The use of absorbing pads and small reflecting plates for sidelobe reduction is also considered. Author

N80-12260*# Mitre Corp., Bedford, Mass.
APPLICATION OF ADVANCED ON-BOARD PROCESSING CONCEPTS TO FUTURE SATELLITE COMMUNICATIONS SYSTEMS
J. L. Katz, M. Hoffman, S. L. Kota, J. M. Ruddy, and B. F. White Jun. 1979 406 p refs 2 Vol.
(Contract F19628-79-C-0001; AF Proj. 8680)
(NASA-CR-159682; MTR-3787-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 17B

An initial definition of on-board processing requirements for an advanced satellite communications system to service domestic markets in the 1990's is presented. An exemplar system architecture with both RF on-board switching and demodulation/remodulation baseband processing was used to identify important issues related to system implementation, cost, and technology development. R.C.T.

N80-12261*# Mitre Corp., Bedford, Mass.
APPLICATION OF ADVANCED ON-BOARD PROCESSING CONCEPTS TO FUTURE SATELLITE COMMUNICATIONS SYSTEMS: BIBLIOGRAPHY
R. L. Edelman and J. L. Katz Jun. 1979 109 p 2 Vol.
(Contract F19628-79-C-0001; AF Proj. 8680)
(NASA-CR-159684; MTR-3787-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 17B

Abstracts are presented of a literature survey of reports concerning the application of signal processing concepts. Approximately 300 references are included. R.C.T.

N80-12262# Polytechnic Inst. of New York. Microwave Research Inst.
***DIELECTRIC GRATING ANTENNAS* Final Report, 1 May 1978 - 31 Jan. 1979**
S. T. Peng 18 Jul. 1979 17 p refs
(Grant DAAG29-78-G-0099)
(AD-A073261; POLY-MRI-1401-79; ARO-15713.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Three basic problems associated with dielectric grating antennas are investigated. First, the radiation characteristics in the stopband region are carefully analyzed, showing the range of blindness of the antenna in the broadside direction. Second, a new perturbation procedure for grating antennas is shown numerically to yield accurate propagation characteristics including the changes in phase as well as decay constant. Finally, the scattering of a plane wave by a dielectric grating at an arbitrary incidence angle is analyzed showing the coupling between TE and TM modes. GRA

N80-12263# Naval Ocean Systems Center, San Diego, Calif.
TACTICAL INTELLIGENCE LINK CONTROL FACILITY (TLCF) SUBSYSTEM RF LINK REMOTING DESIGN AND INSTALLATION PLANS
D. P. Hurst Mar. 1979 40 p refs
(AD-A071789; NOSC/TD-216) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report documents Tactical Intelligence Link Control Facility (TLCF) rf link remoting design and installation plans. It presents TLCF subsystem configurations, lists and describes equipments associated with remoting, gives remoting considerations, and states rf link remoting system requirements/specifications. GRA

N80-12264# Southern Research Inst., Birmingham, Ala.
CONTRAST ENHANCEMENT METHODS FOR VIDEO SYSTEMS Final Report, 30 May 1978 - 30 May 1979
Albert L. Thomas, Jr. 1 Jun. 1979 56 p refs
(Contract DAAK40-78-C-0155)
(AD-A073076; SORI-EAS-79-330; SOR-4106-9) Avail: NTIS HC A04/MF A01 CSCL 14/5

Methods have been studied of improving the display contrast of targets observed by TV search and tracking systems. Typical camera components can be improved upon several fold by spectral selection, lens selection, and optimum exposure of high resolution vidicons. Stationary noise can be reduced by pixel sensitivity equalization (PSE) and dynamic noise can be reduced by multiframe averaging. Local area gain and brightness control (LAGBC) can be applied to raise the differential contrast of small, target-sized areas after reducing the total scene contrast. Schemes for rendering PSE and LAGBC are diagrammed. About 70 items of technical and commercial literature are cited. GRA

N80-12265# Harry Diamond Labs., Adelphi, Md.
HEMP STUDY OF PLANNED DAS3 CONFIGURATION
Thomas A. Rose Jun. 1979 71 p refs
(AD-A072948; HDL-TR-1891) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results of a preliminary study to determine high-altitude electromagnetic pulse (HEMP) protection measures required for the Decentralized Automated Service Support System (DAS3). The DAS3 planned configuration

examined consists of automatic data processing equipment (ADPE) housed in an XM971 semitrailer van and powered by commercial power or two MEP-005A, 30 kW, 50/60 Hz, 120/208 V generators. The ADPE is commercial, off-the-shelf computer equipment which is, as yet, not fully defined as to manufacturer and specific components. The DAS3 system was examined in order to identify possible or definite weaknesses from an HEMP susceptibility standpoint and to provide recommendations for enhancing the overall HEMP survivability. GRA

N80-12266# Harris Corp., Melbourne, Fla. Government Communication Systems Div.

CROSS POLARIZATION INTERFERENCE REDUCTION TECHNIQUES Final Report, Sep. 1977 - Dec. 1978

Bruce E. Gillingham, Charles A. Baird, and M. Guy Pelchat Jun. 1979 178 p refs

(Contract F30602-77-C-0100; AF Proj. 4519)

(AD-A072748; RADC-TR-79-154) Avail: NTIS HC A09/MF A01 CSCL 20/14

The objective of this program was to design, fabricate and test the optimum algorithm developed on the previous contract (Contract F30602-76-C-0041) to improve the performance of cross-polarization on line-of-sight (LOS) digital microwave channels. Specifically, an adaptive equalizer which would function with cross-polarization discrimination ratios from 5 dB to 40 dB and provide up to 20 nanoseconds of linear and parabolic group delay compensation was desired. An experimental equalizer was constructed and successfully tested both in the laboratory and at RADC. All primary design objectives were met with the exception of automatic operation in the copolar mode. Theoretical limitations of the performance measurement techniques used in the equalizer restrict copolar operation to a manual mode. In the automatic cross-polar mode, the equalizer can reduce an input cross-polarization discrimination ratio (CPDR) of 5 dB to a CPDR near 25 dB with the modem signal meeting FCC 19311 requirements over an LC8D radio. Non-dispersive cross-pole interference can be reduced by 25 dB. In back-to-back modem tests, the equalizer's residual interference level is near the design objective of -40 dB. GRA

N80-12267# Rome Air Development Center, Griffiss AFB, N.Y.

MUTUAL COUPLING EFFECTS ON A CIRCULAR ARRAY OF DIPOLES

Gregory Cruz Apr. 1979 25 p

(AF Proj. 2305)

(AD-A073077; RADC-TR-79-82) Avail: NTIS HC A03/MF A01 CSCL 20/14

An analysis of coupled dipoles based on integral equations for currents that must be satisfied in order to meet the boundary conditions along the surface of the elements. The computer is used to numerically solve the M nonhomogeneous integral equations, using numerical approximations for the integrals and complex algebra techniques to solve the simultaneous equations. Such an analysis displays the mutual and self-admittance characteristics of a circular array and determines the effects of mutual coupling on the active element pattern. GRA

N80-12268# Mississippi Univ., University.

NUMERICAL COMPUTATION OF ELECTROMAGNETIC SCATTERING BY INHOMOGENOUS PENETRABLE BODIES

S. Govind and D. R. Wilton Jul. 1979 211 p refs

(Contract F30602-78-C-0148; AF Proj. 2338)

(AD-A073143; RADC-TR-79-172) Avail: NTIS HC A10/MF A01 CSCL 20/14

Different approaches for studying scattering by inhomogeneous dielectric bodies are considered. The unimoment method, a differential equation approach, and the integral equation approach are discussed in detail. The integral equation approach with unknown equivalent surface currents is selected for further study. For this formulation, layered inhomogeneities result in an overall system matrix which is block-tridiagonal, the solution of which can be obtained through an iterative procedure. Such an iterative procedure reduces the computer core storage requirement as compared to a simultaneous solution of the unknown surface currents on the interfaces. The procedure is tested by applying it first to solve for the surface currents on layered spheres and comparing the results to an exact eigen-function solution. The procedure is then extended to permit the determination of the current on a missile in the presence of a trailing inhomogeneous exhaust plume. The resultant system matrix in this case, though not strictly block-tridiagonal, is again transformed by suitable matrix partitioning into a block-tridiagonal form. The currents on the missile are obtained for selected plume inhomogeneities at various frequencies and angles of incidence. In the appendix, various possible surface current formulations and the uniqueness of corresponding solutions are discussed. GRA

N80-12269# Army Communications Research and Development Command, Fort Monmouth, N. J.

SCATTERING FROM PERIODIC SURFACES WITH SINUSOIDAL HEIGHT PROFILE. A THEORETICAL APPROACH. PART 2: NUMERICAL EVALUATION Final Report, 1 Jul. 1973 - 30 Jun. 1978

G. M. Whitman and F. Schwering Jun. 1979 70 p

(AD-A072998; CORADCOM-79-5-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 20/3

A computer program was written. Numerical evaluations were performed. Program outputs include the current distribution in the metal surface, the complex amplitudes of the plane wave spectrum (space harmonics representation) of the scatter field and an accuracy check based on conservation of power. This data was computed for both TE-and TM-polarization, where TE and TM is understood with respect to the direction of the surface grooves. The study was performed in support of work on a practical problem, the polarization question of microwave landing systems. One of the aspects of this problem concerns scattering by large periodic metal surfaces, such as hangar doors, and the question whether the specular reflection coefficient of such surfaces can be significantly reduced by appropriate choice of polarization. The numerical results confirm experimental evidence that horizontal polarization generally leads to substantially less specular reflection than vertical polarization, in particular in the interesting range of large angles of incidence (near grazing). R.E.S.

N80-12270# Army Communications Research and Development Command, Fort Monmouth, N. J.

SCATTERING FROM PERIODIC SURFACES WITH SINUSOIDAL HEIGHT PROFILE. A THEORETICAL APPROACH. PART 1: THEORY Final Report, 1 Jul. 1973 - 30 Jun. 1978

G. M. Whitman and F. Schwering Jun. 1979 29 p refs

(AD-A072984; CORADCOM-79-4) Avail: NTIS HC A03/MF A01 CSCL 20/3

A theory scattering by periodic metal surfaces is presented which utilizes the physical optics approximation to determine the current distribution in the metal surface in first order, but modifies this approximate distribution by multiplication with a Fourier series whose fundamental period is that of the surface profile (Floquet's theorem). The coefficients of the Fourier series are determined from the extended boundary condition that the field radiated by the current distribution into the lower (shielded) half-space must cancel the primary plane wave in this space range. The theory reduces the scatter problem to the familiar task of solving a linear system. For certain basic topics of surface profiles, including the sinusoidal profile considered here, the coefficients of the linear system are obtained as closed form expressions in well-known (Bessel) functions for sinusodial profiles and exponential functions for piece-wise linear profiles). The theory is thus amenable to efficient computer evaluation. GRA

N80-12271# Army Communications Research and Development Command, Fort Monmouth, N. J.

A RIGOROUS THEORY FOR PLANE WAVE SCATTERING FROM PERIODIC TRAPEZOIDAL METAL SURFACES Final Report, 1 Jul. 1973 - 30 Jun. 1978

G. M. Whitman, D. M. Leskin, and F. Schwering Jun. 1979 91 p refs

(AD-A072983; CORADCOM-79-3) Avail: NTIS HC A05/MF A01 CSCL 20/3

A rigorous method for analyzing plane wave scattering from perfectly conducting periodic surfaces is examined and applied to trapezoidal profiles. Both TE - and TM - polarizations of the incident plane wave are considered. An integral equations for the unknown current distribution in the metal surface is

formulated by invoking the extended boundary condition. Upon expressing the current density in terms of its physical optics approximation multiplied by a Fourier series, the integral equation reduces to a linear system of equations. For the case of a piecewise linear surface profile, the coefficient matrix of this system involves closed form expressions only. As a consequence, the linear system is amenable to efficient computer evaluation, which furnishes the Fourier coefficients of the current distribution. The method is applied to trapezoidal scatterers for which little data is available in the literature, and, by using appropriate limiting procedures, to triangular and rectangular profiles. Scatter fields and surface current densities are calculated. The accuracy of the method, its range and limitations, are investigated and comparisons are made with the results of others. The method has given accurate results for surface groove depths of less than half a wavelength and for surface periods of greater than a wavelength at minimal computational cost. GRA

N80-12272# Ohio State Univ., Columbus. Electroscience Lab.

SUBSURFACE ELECTROMAGNETIC TARGET CHARACTERIZATION AND IDENTIFICATION Ph.D. Thesis

Luen Charm Chan Jun. 1979 277 p refs

(Contract DAAK70-77-C-0114)

(AD-A072491; ESL-784722-3) Avail: NTIS

HC A13/MF A01 CSCL 17/9

A method for subsurface radar target characterization and identification is described. This method characterizes subsurface radar targets by their complex natural resonances which are extracted directly from their backscattered timedomain waveforms. The difference equation coefficients associated with the complex resonances are then used in the predictor-correlator for target identification. Both the characterization and identification processes are extensively tested with real radar measurements and found to yield practical target identification performance. The target identification process is simple and involves only simple algebraic operations. Based on the identification process, a first-generation microcomputer identification radar system is implemented for target identification in real time. This radar system is found to yield practical identification performance. GRA

N80-12273# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.

SCATTERING OF ELECTROMAGNETIC WAVES BY OBSTACLES IN PRESENCE OF THE EARTH'S SURFACE CURRENT DISTRIBUTION ON PERFECTLY CONDUCTING CYLINDRICAL LOOPS IN AN INCIDENT Final Report, 21 Apr. 1977 - 30 Sep. 1978

T. T. Wu and H. M. Lee Griffiss AFB, New York RADC Jun. 1979 24 p refs

(Contract F19628-77-C-0146; AF Proj. 2305)

(AD-A072880; RADC-TR-79-134) Avail: NTIS

HC A02/MF A01 CSCL 20/3

The current distribution excited by an external field on a perfectly conducting cylindrical loop with zero thickness placed above the earth's surface with its axis normal to the earth is obtained. The case two coupled coaxial loops at different separations has also been solved. A variational principle is employed in the derivation. GRA

N80-12274# Data/Ware Development, Inc., San Diego, Calif.

ADVANCED DIGITAL TV SYSTEM Final Report, Jun. - Sep. 1977

Philip J. Erdelsky, Richard V. Keele, G. Graham Murray, and Ronald B. Weiss Wright-Patterson AFB, Ohio AFAL Feb. 1979 346 p

(Contract F33615-77-C-1198; AF Proj. 6096)

(AD-A072917; AFAL-TR-79-1006) Avail: NTIS

HC A15/MF A01 CSCL 09/2

A laboratory version of a programmable digital processor system for TV bandwidth reduction was designed and placed in operation. The system consists of a TV camera A/D converter unit, two pipelined microprocessor units, and a frame store D/A-TV display unit interfaced to a PDP 11/04 minicomputer controller in such a manner that data transfers can be effected between any two units over the PDP 11/04 Unibus under software control of the CPU. The pipelined microprocessor units are software programmable via local program stores which are loaded over the PDP 11/04 Unibus. Each pipelined processor is twelve bits wide and uses three AMD 2901 bit-slice microprocessor chips in conjunction with a 12x12 bit hardware multiplier for high speed computation. GRA

N80-12275# M/A-COM, Inc., Burlington, Mass.

COMMUNICATIONS TECHNOLOGY IN THE 10 TO 40 GIGAHERTZ FREQUENCY BAND

Apr. 1979 140 p

(PB-297221/4; FCC/OST/SA-79/03) Avail: NTIS

HC A07/MF A01 CSCL 17B

The state-of-art in communications technology in the 10-40 GHz band with emphasis on the trade-offs between cost and performance are presented. System considerations, propagation characteristics, FM transmission and interference, digital modulation, rf power sources, frequency stability, and rf low-noise amplifiers and mixers are included. GRA

N80-12276# National Bureau of Standards, Washington, D.C. Electromagnetic Technology Div.

ELECTROMAGNETIC INTERFERENCE (EMI) RADIATIVE MEASUREMENTS FOR AUTOMOTIVE APPLICATIONS

J. W. Adams, H. E. Taggart, M. Kanda, and J. Shafer Jun. 1979 49 p refs Sponsored in part by Natl. Highway Traffic Safety Admin., Washington D.C.

(PB-298605/7; NBS-TN-1014) Avail: NTIS

HC A03/MF A01 CSCL 13F

The measured results of the electromagnetic (EM) environment encountered by three different-sized vehicles exposed to a selection of CB and mobile radio transmitters and broadcast stations are described. The electric and magnetic fields were measured independently. The EM environmental conditions under different circumstances were identified in order to estimate electromagnetic compatibility testing criteria for vehicles and their electronic systems. GRA

N80-12277# Institute for Telecommunication Sciences, Boulder, Colo.

STATISTICAL METHODS FOR ESTIMATING TIME AND RATE PARAMETERS OF DIGITAL COMMUNICATION

Edwin L. Crow Jun. 1979 39 p refs

(PB-297977/1; NTIA/Rept-79/21) Avail: NTIS

HC A03/MF A01 CSCL 17B

Statistical methods are given for estimating time and rate parameters of digital communication systems according to the specifications of proposed federal standards. The methods may be applied to delay, disengagement, transfer and service times, and to transfer rates. Some ARPANET and Bell System data are examined for the form of distribution of times. The properties of various types of estimators are discussed, and the sample mean is recommended. Approximate confidence limits are given for time and rate parameters. A step by step procedure is provided for designing an experiment to estimate time and rate parameters with prescribed accuracy. GRA

N80-12278# Institute for Telecommunication Sciences, Boulder, Colo.

GROUND WAVE PROPAGATION OVER IRREGULAR, INHOMOGENOUS TERRAIN: COMPARISONS OF CALCULATIONS AND MEASUREMENTS

R. H. Ott, L. E. Vogler, and G. A. Hufford May 1979 140 p refs Sponsored in part by SAMSO and Electromagnetic Compatibility Anal. Center

(PB-298668/5; NTIA/REPT-79/20) Avail: NTIS

HC A07/MF A01 CSCL 20N

An algorithm (PROGRAM WAGNER) that evaluates HF ground-wave attenuation over irregular, inhomogeneous terrain is used to compare calculated field strengths with observed measurements for 9 actual paths and frequencies ranging from 120 kHz to 50 MHz. All comparisons show encouraging agreement between calculations and measurement. The 20 MHz comparisons over the Colorado Mountains provided a challenge for PROGRAM WAGNER. GRA

N80-12279# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.

PROCEEDINGS OF THE 1978 ELECTROMAGNETIC INTERFERENCE WORKSHOP Final Special Publication

M. G. Arthur, ed. Jul. 1979 62 p Workshop held in Gaithersburg, Md., 2-3 Nov. 1978
(PB-298675/0; NBS-SP-551; LC-79-600091) Avail: NTIS HC A04/MF A01 CSCL 20N

A summary of the overview talks and session discussions at the 1978 Electromagnetic Interference Workshop is presented. These discussions addressed the following questions: What are the significant electromagnetic interference (EMI) problems. How serious are they. Which should be tackled first. What solutions are practical. Who is responsible for solutions. What new standards or changes in present voluntary standards are needed. What is needed for process. Impacted areas featured at the workshop included communications, transportation, consumer products, industrial, and medical. Workshop speakers and attendees represented a broad segment of decisionmakers in both industry and government. GRA

N80-12218 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

PERFORMANCE AND IMPAIRMENTS IN A QPSK SATELLITE TO GROUND LINK

P. Amadesi, L. Moreno, and M. SantAgostino *In its* Space Commun. Mar. 1979 p 59-107 refs Sponsored by ESA Submitted for publication (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12219 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SYNCHRONIZATION PROCEDURES FOR A REGENERATIVE SS-TDMA SYSTEM

D. DiPino and R. Preti *In its* Space Commun. Mar. 1979 p 109-124 refs Submitted for publication (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12220 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

THE TELECOMMUNICATION SATELLITE AS AN INTEGRATED TIME DIVISION TRANSMISSION-SWITCHING SYSTEM

A. deFlammineis and A. Loffreda *In its* Space Commun. Mar. 1979 p 125-134 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12221 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

TRAFFIC SIMULATION IN A TELEPHONE NETWORK VIA SATELLITE WITH PREASSIGNED AND DEMAND ASSIGNED CIRCUITS

F. Manucci and A. Tonietta *In its* Space Commun. Mar. 1979 p 135-144 refs Repr. from IEE Conf. Digital Satellite Commun., Publ. 59 Sponsored by Intern. Telecommun. Satellite Consortium (INTELSAT) (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12222 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN APPROACH TO BLOCKED APERTURE SYNTHESIS

P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 183-186 refs Presented at European 77, Venice, May 1977 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12223 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYSIS AND SYNTHESIS OF CORRUGATED CONICAL HORNS

P. Bielli, Salvatore DePadova, and E. Pagana *In its* Space Commun. Mar. 1979 p 195-200 refs Presented at 6th European Microwave Conf., Rome, Sep. 1976 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12224 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

A METHOD FOR COMPUTING CORRUGATED HORNS PHASE CENTER

P. Bielli, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 201-206 refs (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12225 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYSIS AND SYNTHESIS OF AN ELLIPTICAL PARABOLOID OFFSET REFLECTOR ANTENNA. AN ELLIPTICALLY SHAPED BEAM ANTENNA

Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 207-210 refs Repr. from Antennas and Propagation, 15-19 May 1978 p 381 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12226 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

ANALYTICAL AND GRAPHICAL METHODS FOR THE DESIGN OF AN ELLIPTICALLY SHAPED BEAM ANTENNA WITH ELLIPTICAL PARABOLOID REFLECTOR

Salvatore DePadova, E. Pagana, and G. Rosenga *In its* Space Commun. Mar. 1979 p 211-215 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12227 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN ELLIPTICALLY SHAPED BEAM ANTENNA

Salvatore DePadova, Enrico Pagana, and Giorgio Rosenga *In its* Space Commun. Mar. 1979 p 229-234 refs Presented at European Microwave Conf., Paris, Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12228 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

REFLECTOR ANTENNAS WITH HIGH EFFICIENCY AND LOW DEPOLARIZATION

P. Bielli and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 235-238 refs Presented at 6th Colloq. on Microwave Commun., Budapest, Aug. - Sep. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12229 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

SOME CONSIDERATIONS ABOUT SKY NOISE TEMPERATURE AT FREQUENCIES ABOVE 10GHz

E. D. Damasso and Salvatore DePadova *In its* Space Commun. Mar. 1979 p 239-247 refs Repr. from Alta Frequenza, v. 65, no. 2, 1976 p 98-10E-106-1BE (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12230 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

BIT RATE REDUCTION BY AUTOMATIC ADAPTATION OF QUANTIZER STEP-SIZE IN DPCM SYSTEMS

Paolo Castellino, Giulio Modena, Luciano Nebbia, and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 257-263 refs Repr. from CSELT Rappt. Tec., no. 2, Sep. 1974 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12231 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

AN ADAPTIVE QUANTIZER WITH CHANNEL ERROR RECOVERY

Carlo Scagliola *In its* Space Commun. Mar. 1979 p 265-272 refs Repr. from CSELT Rappt. Tec., no. 4, Dec. 1976 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12233 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
EVALUATION OF ADAPTIVE SPEECH CODERS UNDER NOISY CHANNEL CONDITIONS
Carlo Scagliola *In its* Space Commun. Mar. 1979 p 277-281 refs Repr. from ICC Conf. Record, v. 1, 4-7 Jun. 1978 p 8.1.1-8.1.5 (For primary document see N80-12216 03-31)
(Contract CH1350-8/78/0000-0037)
Copyright. Avail: Issuing Activity

N80-12234 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
AN ADAPTIVE DELTA MODULATOR ROBUST TO TRANSMISSION ERRORS
Paolo Castellino *In its* Space Commun. Mar. 1979 p 283-287 refs Presented at 4th Intern. Conf. on Digital Satellite Commun., Montreal, Oct. 1978 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

N80-12235 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
TRANSFORM CODING OF PAL COMPOSITE SIGNALS
L. Chiariglione, M. Guglielmo, and Sciarappa *In its* Space Commun. Mar. 1979 p 289-312 refs Submitted for publication
(For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also 60 Computer Operations *and Hardware and 76 Solid-State Physics.*

N80-12280 Columbia Univ., New York.
TRANSPORT THEORY OF CARRIERS ACROSS SEMICONDUCTOR HETEROJUNCTION INTERFACES **Ph.D. Thesis**
Chi-ming Morris Wu 1979 142 p
Avail: Univ. Microfilms Order No. 7925001

A sliding-boat liquid-phase-epitaxial system is built to fabricate AlxGa1-x As heterojunction diodes to examine the model described. A method is proposed to find the conduction band discontinuity by analyzing the temperature-dependent I-V data of the N-p heterojunction diode. Theoretical I-V curves are in agreement with experimental data obtained from AlxGa1-x As-GaAs DH laser diodes which consist of an N-p anisotype heterojunction and ohmic N-n and P-p isotype heterojunctions. The transport theory is applied to investigate the mechanism of carrier leakage over the confining barrier and to determine an appropriate molar composition of tenary compound in DH laser diodes. Dissert. Abstr.

N80-12281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF MAKING V-MOS FIELD EFFECT TRANSISTORS **Patent Application**
Murzban D. Jhabvala, inventor (to NASA) Filed 5 Sep. 1979 12 p
(NASA-Case-GSC-12515-1; US-Patent-Appl-SN-072727) Avail: NTIS HC A02/MF A01 CSCL 09A

A method of making V-MOS field effect transistors is disclosed. A masking layer is first formed over a surface of a crystalline substrate. An aperture is formed in the masking layer to expose the surface of the substrate. An anisotropic etchant is applied to the exposed surface so that a groove having a decreasing width with increasing depth is formed. The etch is not allowed to go to completion, with the result that a partially formed V-shaped groove is formed. Ions are accelerated through the aperture for implantation in the crystalline substrate in the lower portion of the partially formed V-shaped groove. An anisotropic etchant is reapplied to the partially formed V-shaped groove, and the etch is allowed to go to completion. NASA

N80-12282*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN INTRODUCTION TO THE BANNING DESIGN AUTOMATION SYSTEM FOR SHUTTLE MICROELECTRONIC HARDWARE DEVELOPMENT
William J. McGrady 3 Apr. 1979 36 p
(NASA-TM-80831; MSC-06779) Avail: NTIS HC A03/MF A01 CSCL 09C

The BANNING MOS design system is presented. It complements rather than supplant the normal design activities associated with the design and fabrication of low-power digital electronic equipment. BANNING is user-oriented and requires no programming experience to use effectively. It provides the user a simulation capability to aid in his circuit design and it eliminates most of the manual operations involved in the layout and artwork generation of integrated circuits. An example of its operation is given and some additional background reading is provided.
M.M.M.

N80-12283*# Research Triangle Inst., Research Triangle Park, N. C. Electronic Technology Div.
AFAL SIMULATION FACILITY/CAPABILITY MANUAL. VOLUME 2: EXECUTIVE SUMMARY. COMPUTER AIDED DESIGN FOR MICROELECTRONICS **Final Report, 30 Jun. 1977 - 31 Mar. 1978**
Ronald L. Earp Wright-Patterson AFB, Ohio AFAL Feb. 1979 206 p
(Contract F33615-76-C-1308; AF Proj. 6096)
(AD-A073383; AFAL-TR-77-118-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/5

The Air Force Avionics Laboratory (AFAL) at Wright-Patterson AFB is the focal point for development of new avionics technology for the Air Force. In order to carry out this responsibility, a significant capability to simulate physical avionics systems and components has been created by the AFAL divisions. This manual presents introductory and summary coverage of the AFAL Computer Aided Design (CAD) Facility in Section I and by presenting more detailed descriptive material in subsequent sections. The contents of Section I address the CAD Facility capabilities from a planning/management viewpoint by relating the laboratory mission to present facility capability through the development of a conceptual simulation class structure. The contents of subsequent sections of this manual address specific facility/capability from a potential-user viewpoint. GRA

N80-12284*# Michigan Univ., Ann Arbor. Electron Physics Lab.
MILLIMETER-WAVE MIXERS AND DETECTORS **Final Report, 1 May 1976 - 30 Apr. 1979**
G. I. Haddad, P. J. McCleer, and J. R. East Aug. 1979 10 p *ref*
(Grant DAAG29-76-G-0232)
(AD-A073591; Rept-014525-F; ARO-13853.3-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

The properties of BARITT devices and their application as mixers and detectors particularly at millimeter wavelengths have been considered and their characteristics have been determined. It is shown that the BARITT device will have several advantages over existing devices such as Schottky-barrier diodes in these applications and thus warrant further development. Several modes of operation have been identified and include: self-oscillating mixers where the device due to its negative resistance generates power and is utilized as a mixer simultaneously; a video detector and mixer element which exhibits a negative resistance over a band of frequencies determined by the width of the depletion layer; and a conventional video detector and mixer element which does not exhibit a negative resistance but has a negligible series resistance due to the basic nature of the device. This leads to a detector and mixer element with an extremely high cut-off frequency and can lead to better performance than existing Schottky-barrier diodes. GRA

N80-12285*# Westinghouse Research and Development Center, Pittsburgh, Pa.
GALLIUM ARSENIDE VERTICAL CHANNEL INSULATED GATE FIELD EFFECT TRANSISTOR **Final Annual Technical Report, Jan. - Dec. 1977**
M. C. Driver, D. L. Barrett, G. W. Eldridge, H. C. Nathanson,

and V. L. Wrick 25 Sep. 1978 79 p refs
(Contract N00014-75-C-0418; RF54481001)
(AD-A073706; Rept-79-9F7-VMIST-R1) Avail: NTIS HC A05/MF A01 CSCL 09/1

The techniques for producing n(-)-p-n(-) structures in gallium arsenides are described. Evaluation of the surface state densities of anodic oxide on gallium arsenide show minima at about mid gap of 2 times 10 to the 11th power eV sq cm. These densities are affected by annealing conditions and their measurement by sweep time. Recommendations for future work include the use of indium phosphide as the semiconductor. GRA

N80-12286# Oregon Graduate Center, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Technical Report, 15 Nov. 1976 - 15 Feb. 1977
L. W. Swanson Wright-Patterson AFB, Ohio AFAL Aug. 1977 72 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A073701; AFAL-TR-77-160; ITR-3) Avail: NTIS HC A04/MF A01 CSCL 20/3

The purpose of this research program is the development of high brightness field emission and field ion sources. A new method of preparing W/Zr TF cathodes is discussed and life test results of LaB6 field emitters are described. Built up emitters of tantalum and iridium have been examined. Results of experiment and calculation are presented for the energy distribution of field emitted electrons from substrates of varying temperature and work function. Field ionization data for several gases has been obtained. Also, noise measurements have been performed for a field ion source. GRA

N80-12287# Air Force Weapons Lab., Kirtland AFB, N. Mex.
METAL-NITRIDE-OXIDE-SEMICONDUCTOR (MNOS) RADIATION CHARACTERIZATION STUDIES Final Report
Roger W. Tallon Jul. 1979 170 p refs
(AD-A073637; AFWL-TR-79-39) Avail: NTIS HC A08/MF A01 CSCL 09/1

This report describes the radiation characterization studies performed at the Air Force Weapons Laboratory (AFWL) on Metal-Nitride-Oxide-Semiconductor (MNOS) transistors, arrays, and related PMOS devices during the period of March 1972 to September 1978. The work presented shows the radiation test data, testing, techniques, and radiation hardening ideas which assisted AFWL in the development of a radiation hard, monolithic, PMOS/MNOS RAM array (the Sperry Rand SR2256). GRA

N80-12288# Argonne National Lab., Ill.
DESIGN AND DEVELOPMENT OF AN ULTRA-THIN SOLENOID FOR A HIGH ENERGY PHYSICS PARTICLE DETECTOR
R. P. Smith, R. C. Niemann, and F. Catania 1978 5 p refs Presented at Applied Superconductivity Conf., Pittsburgh, 25 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-780952-28) Avail: NTIS HC A02/MF A01

An enhanced-stability thin solenoid magnet design is presented. The details of the high purity aluminum stabilized conductor are discussed. The design details of a special cryostat constructed for conductor evaluation is presented, and the aluminum alloy NbTi superconductor under procurement is described. DOE

N80-12289# Sandia Labs., Albuquerque, N. Mex. Model Shops and Inspection Div.
MICROPROCESSOR-CONTROLLED, PROGRAMMABLE RAMP VOLTAGE GENERATOR
J. Hopwood Nov. 1978 55 p
(Contract EY-76-C-04-0789)
(SAND-78-8040) Avail: NTIS HC A04/MF A01

A special-purpose voltage generator was developed for driving the quadrupole mass filter of a residual gas analyzer. The generator is microprocessor-controlled with desired ramping parameters programmed by setting front-panel digital thumb switches. The start votage, stop voltage, and time of each excursion are selectable. A maximum of five start-stop levels may be pre-selected for each program. The ramp voltage is 0 to 10 volts with sweep times from 0.1 to 999.99 seconds. DOE

N80-12290# Bendix Corp., Kansas City, Mo.
FEASIBILITY OF ELECTROPLATED GOLD FOR HYBRID MICROCIRCUITS
P. L. Blessner 1978 27 p refs
(Contract DE-AC04-78DB-00613)
(BDX-613-2114) Avail: NTIS HC A03/MF A01

Electroplating was investigated as a method of providing thick gold films. The characteristics of electroplated gold and its compatibility with present hybrid microcircuits fabrication processes were determined. Ceramic substrates 95 by 114 mm micrometers were electroplated with 6, 10, and 25 micrometers of gold after 0.02 micrometers of chrominum and 0.5 micrometers of gold were either sputtered or vacuum evaporated onto the substrate surfaces. Substrates vacuum evaporated with 6 micrometers of gold were used as a control group. The substrates were evaluated for via resistance, RF electrical characteristics, conductor definition and resolution, solder wettability, thermocompression bondability, and environmental stability. DOE

N80-12291# Gutehoffnungshuette Sterkrade A.G. Oberhausen (West Germany).
ELECTRIC POWER GENERATION AND LNG EVAPORATION WITH THE AID OF GAS TURBINES WITHIN A CLOSED-CYCLE PROCESS
D. Weber 1978 19 p refs In GERMAN Presented at Systems Exhibition Energy - Hanover Fair, Hanover, 19 Apr. 1978
(AED-Conf-78-155-010; CONF-7804102-6) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

In the proposed process the working fluid of a gas turbine plant with a closed circuit is cooled to -140 C with LNG before entering the compresser and heated to +720 C before entering the turbine by means of external heat gained by burning natural gas. With a 1 million cubic m/h throughput of LNG in its normal state, 237 MW of electric power can be generated with 53 percent efficiency with this simple circuit, which can be further developed. In a combination of closed gas turbine and diesel generator, almost 289 MW of electric power can be produced per 1 million cubic m/h LNG with an efficiency of 60 percent. DOE

N80-12292# Sandia Labs., Albuquerque, N. Mex.
ANALYSIS OF LATCH-UP PREVENTION IN CMOS IC'S USING AN EPITAXIAL-BURIED LAYER PROCESS
D. B. Estreich, A. Ochoa, Jr., and R. W. Dutton (Stanford Univ., Palo Alto, Calif.) 1978 5 p refs Presented at IEEE Electron Device Meeting, Washington, D.C., 4 Dec. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1648; CONF-781210-2) Avail: NTIS HC A02/MF A01

The use of a P(+) buried layer beneath the p-well in CMOS is evaluated for controlling latch-up (parasitic SCR action). It is shown that this structure typically reduces the parasitic n-p-n transistor's current gain by two orders of magnitude. The n-p-n gain reduction is the principal mechanism for latch-up control. The n-p-n is studied using STRAP to numerically solve the transport equations. These simulations show the n-p-n current gain to be primarily governed by the base-retarding field arising from the impurity gradient of the outdiffusing buried layer. A wide-base lateral p-n-p model is developed to accurately model the field enhancement of the parasitic lateral p-n-p's current gain. Experimental confirmation of the lateral p-n-p model is given. DOE

N80-12293# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF THIN FILM MICROSTRIP ATTENUATORS AT MICROWAVE FREQUENCIES
F. R. Smith Nov. 1978 20 p ref
(Contract EY-76-C-04-0613)
(BDX-613-1857-Rev) Avail: NTIS HC A02/MF A01

An investigation of thin film microstrip attenuators resulted in the development of characteristics for attenuator fabrication and defined the criteria for microwave performance. The understanding of microstrip resistive attenuator characteristics at microwave frequencies was improved. The process of modeling and fabricating the thin film networks is defined. An attenuator

configuration which approaches ideal microwave operation were developed. DOE

N80-12294# California Univ., Berkeley. Lawrence Berkeley Lab.
GERMANIUM FIELD-EFFECT TRANSISTOR MADE FROM A HIGH-PURITY SUBSTRATE
W. L. Hansen, Frederick S. Goulding, and Eugene E. Haller Nov. 1978 19 p refs Presented at IEEE Nucl. Sci. Symp., Washington, D.C., 18 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8134; CONF-781033-44) Avail: NTIS HC A02/MF A01

Field effect transistors were fabricated on high-purity germanium substrates using low-temperature technology. The low density of trapping centers in high-quality starting material was preserved by low-temperature processing. The use of germanium promises to eliminate some of the traps which cause generation-recombination noise in silicon field-effect transistors (FET's) at low temperatures. Present devices exhibit a large 1/f noise component and most of this noise must be eliminated if they are to be competitive with silicon FET's commonly used in high-resolution nuclear spectrometers. DOE

N80-12295# Argonne National Lab., Ill.
ARGONNE PROGRAM TO ASSESS SUPERCONDUCTING STABILITY
S. T. Wang, L. R. Turner, Y. C. Huang, J. W. Dawson, J. Harrang, M. A. Hilal, M. Lieberg, J. D. Gonczy, and S. H. Kim 1978 46 p refs Presented at the Superconducting MHD Magnet Design Conf., Cambridge, Mass., 18-19 Oct. 1978
(Contract W-31-109-eng-38)
(CONF-781055-3) Avail: NTIS HC A03/MF A01

To assess superconductor stability, a complete program is developed to obtain basic information on the effects of local mechanical perturbations on the cryostatic stability. An analytical model for computing the transient recovery following the mechanical perturbation is developed. A test program is undertaken to develop data needed to verify the conclusions reached through the analytical studies. DOE

N80-12296# Princeton Univ., N. J. Plasma Physics Lab.
NUMERICAL STUDIES OF CURRENT GENERATION BY RADIO-FREQUENCY TRAVELING WAVES
C. F. F. Karney and N. J. Fish Jan. 1979 42 p refs
(Contract EY-76-C-02-3073)
(PPPL-1506) Avail: NTIS HC A03/MF A01

By injecting radio-frequency traveling waves into a Tokamak, continuous toroidal electron currents may be generated. This process is studied by numerically solving the two-dimensional Fokker-Planck equation with an added quasilinear term. The results are compared with the one-dimensional analytic treatment of Fisch, which predicted a reduced plasma resistivity when high-phase-velocity waves are employed. It is shown that two-dimensional velocity space effects, while retaining the predicted scaling, further reduce the ratio of power dissipated to current generated by about 40%. These effects enhance the attractiveness of steady-state Tokamak reactors utilizing this method of current generation. DOE

N80-12297# Electro Engineering Works, San Leandro, Calif.
STUDY PROGRAM FOR CONSTANT CURRENT CAPACITOR CHARGING METHOD
C. Pugh 4 Oct. 1978 98 p
(Contract W-7405-eng-48)
(UCRL-13914) Avail: NTIS HC A05/MF A01

The best method of charging 20,000 to 132,000 microfarads of capacitance to 22 kVdc in 14 to 15 sec was determined. Component costs, sizes, weights, line current graphs, copies of calculations and manufacturer's data are included. DOE

N80-12298# Oak Ridge National Lab., Tenn.
TRANSIENT 3-D EDDY CURRENT IN MULTIPLE CONDUCTORS
H. T. Yeh 1979 12 p refs Presented at the Joint INTERMAG-MMM Conf., New York, N. Y., 17 Jul. 1979
(Contract W-7405-eng-26)
(CONF-790738-2) Avail: NTIS HC A02/MF A01

A computer program was implemented to model the transient eddy current in multiple thin conductors. This program allows for holes and multiple materials and has symmetry options built in. For cases with known solutions, the program was checked for the eddy current induced in a cross, a plate with holes, a bent plate, an aluminum plate coil case, a plate with two materials and multiple plates. DOE

N80-12299# Martin Marietta Aerospace, Orlando, Fla.
INVESTIGATION OF MOISTURE MEASUREMENTS, FAILURE RATE AND LEAK RATE AND A STUDY OF MOISTURE INFUSION Final Report
R. L. Sulouff Aug. 1979 57 p refs
(Contract NBS-5-35880; ARPA Order 2397)
(PB-299172/7; NBS-GCR-79-170) Avail: NTIS
HC A04/MF A01 CSCL 09A

A preliminary study of the relationships between moisture infusion, leak size, and device reliability is presented. The results exhibited a great amount of scatter, both because of the primitive nature of the measurement methods available for use in this type of experiment and because of the large variability in both water vapor infusion and the reactions of water vapor on device surfaces. It was concluded that present leak rate limits for large packages are not low enough to insure that the maximum permissible moisture level are not exceeded during a reasonable service life. GRA

N80-12300# National Bureau of Standards, Washington, D.C. Electron Devices Div.
MEASUREMENT TECHNIQUES FOR HIGH-POWER SEMICONDUCTOR MATERIALS AND DEVICES: Annual Report, 1 Oct. 1977 - 30 Sep. 1978
Frank F. Oettinger Jun. 1979 146 p refs
(Contract EA-77-A-01-6010)
(PB-298574/5; NBSIR-79-1756) Avail: NTIS
HC A07/MF A01 CSCL 09A

The development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy technologies is described. The major tasks are: (1) to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime controlling or leakage source defects in power grade silicon material and devices; and (2) to develop procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis. GRA

N80-12301# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: THERMAL RESISTANCE MEASUREMENTS ON POWER TRANSISTORS Final Report
Sherwin Rubin and Frank F. Gettinger Apr. 1979 73 p refs
(PB-298318/7; NBS-SP-400-14) Avail: NTIS
HC A04/MF A01 CSCL 09A

The idealized concept of thermal resistance is given along with the problems and pitfalls encountered in applying the concept to power transistors. The advantages and disadvantages of various electrical techniques for measuring junction temperature (thermal resistance) are described. A preferred technique, in which the forward-biased emitter-base junction is used as the temperature-sensitive parameter, is usable on all types of bipolar transistors. The measurement procedure is relatively simple and lends itself to industrial measurements as well as for referee purposes. The power interruption circuitry is also relatively fast and simple since only one device terminal is switched. GRA

N80-12018# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ELECTRIC MEASUREMENT OF CRACK LENGTH
Georges Baudin and Humbert Policella In its La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 125-144 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978 p 195-203 Original language report was announced as A79-11136 (For primary

document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

N80-12215 Institut Franco-Allemand de Recherches, St. Louis (France).
FANNING OF SPARK DISCHARGES
M. Schwertl and A. Stenzel *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 260-268 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12217 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
RELIABILITY PERFORMANCES OF SYSTEMS WITH A SWITCHING MATRIX
C. DallOlio *In its* Space Commun. Mar. 1979 p 21-58 refs Submitted for publication (For primary document see N80-12216 03-31)
(Contract ESTEC-2872/76/NL-AK(SC))
Copyright. Avail: Issuing Activity

N80-12232 Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
DESIGN OF INSTANTANEOUSLY COMPANDED DELTA MODULATORS WITH M-BIT MEMORY
Paolo Castellino and Carlo Scagliola *In its* Space Commun. Mar. 1979 p 273-276 refs Presented at IEEE Intern. Conf. on Acoustics, Speech and Signal Process., 1977 (For primary document see N80-12216 03-31)
Copyright. Avail: Issuing Activity

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-12302 City Univ. of New York, N. Y.
SOLUTIONS OF PRANDTL'S BOUNDARY LAYER EQUATIONS USING LINEAR PROGRAMMING AND MAPPINGS Ph.D. Thesis
Gerald Michael Flynn 1979 48 p
Avail: Univ. Microfilms Order No. 7923726

A method of solution to Prandtl's boundary layer equations is proposed and tested for three representative cases. The test flows are: (1) past a flat plate parallel to the stream, (2) past a circular cylinder and (3) linearly retarded flow. Calculations of the boundary layer thicknesses, velocity profiles, and shearing stresses are made and compared to known classical calculations. In the latter two cases, the point of separation is calculated.
Dissert. Abstr.

N80-12303 New York Univ., N. Y.
TWO-DIMENSIONAL VORTICAL MOTION Ph.D. Thesis
Sergio H. Lopez-Fernandez 1979 46 p
Avail: Univ. Microfilms Order No. 7925490

The motion of two rectilinear isolated vortices in a plane layer of incompressible, inviscid fluid contained in a simply connected domain, when one of the vortices is fixed in position and the other is free to move is presented. The only restriction in the domain is a reasonably shaped boundary which is impermeable, so that any flow must be tangent to it. It is proven that for any such domain, it is always possible to find configurations of positions and relative vortex strength lambda for which the free vortex is in a stationary position. Criteria are established for the stationary configuration. The split plane is taken as a special case and a method is developed to determine all stationary configurations. The stability is studied and trajectories of the free vortex are sketched for several ranges of values of lambda.
Dissert. Abstr.

N80-12304 New York Univ., N. Y.
SOME MINIMAX PRINCIPLES WITH APPLICATIONS IN NONLINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS AND GLOBAL VORTEX FLOW Ph.D. Thesis
Wei-Ming Ni 1979 119 p
Avail: Univ. Microfilms Order No. 7925503

Minimax principles are presented and applied to nonlinear elliptic boundary value problems and fluid dynamic problems. The principles are designed to obtain critical points (in general, saddle points) of some functionals on R to the nth power, Banach spaces, Riemannian manifolds or Banach manifolds. The existence of axial-symmetric stationary global flow in R to the 3rd power with nontrivial vortex rings was determined.
Dissert. Abstr.

N80-12305 New York Univ., N. Y.
PERTURBED BIFURCATION THEORY FOR PLANE POISEUILLE FLOW Ph.D. Thesis
Gary Steven Strumolo 1979 111 p
Avail: Univ. Microfilms Order No. 7925534

The problem of a two dimensional viscous fluid flow between two parallel, infinite plates is addressed. By means of a linear stability analysis, it is shown that Poiseuille flow is stable for values of the Reynolds number, R, less than some critical value R sub c approximates 5772.22, and unstable for R > R sub c. The effects of perturbing the location of the upper wall is considered. The perturbation is considered as either an imperfection in the system or as a condition imposed on the system artificially. In the former case, if the imperfection has a component with a prescribed spatial and temporal frequency, then the solution of this perturbed problem will experience a transition near the Reynolds numbers found by experiment. In this way, a mechanism to reconcile theory and experiments is proposed. Dissert. Abstr.

N80-12308 Virginia Polytechnic Inst. and State Univ., Blacksburg.
VELOCITY AND TEMPERATURE FIELDS IN OSCILLATING BOUNDARY LAYERS Ph.D. Thesis
Maria Sybilla Romaniuk 1978 151 p
Avail: Univ. Microfilms Order No. 7925380

The response of boundary layer velocity and temperature distributions to small amplitude oscillations imposed by the free-stream is investigated. A straightforward combination of perturbation and numerical methods is applied. The analysis of the effect of the frequency of oscillations shows that in many respects the response of the boundary layer to the oscillations in time is periodic in xi (xi = frequency parameter), with the period delta xi approximately 4.0 and the first harmonic manifesting itself strongly at xi approximately 1.15. It is concluded that the interaction between the random turbulent motion and oscillations is probably too strong to be neglected and therefore more complex models, capable of incorporating the interaction process, are required to successfully predict the behavior of oscillatory turbulent boundary layers.
Dissert. Abstr.

N80-12307 Carnegie-Mellon Univ., Pittsburgh, Pa.
SPREADING KINETICS OF A LIQUID DROP ON A SOLID SURFACE Ph.D. Thesis
Parthasakha Neogi 1979 101 p
Avail: Univ. Microfilms Order No. 7919150

The effect of surface roughness on spreading rates of liquid drops was analyzed using a model in which a liquid drop spreads over the surface of a porous medium filled with the same liquid. The equations of motion in the drop are simplified with the lubrication theory approximation and then solved for both zero and small but finite contact angles by the method of matched asymptotic expansions. Although the largest pressure gradients and velocity gradients occur near the contact line at the drop periphery, behaviour in this region is not singular as found in previous analyses of spreading on perfectly smooth surfaces. Qualitative features observed for spreading drops, e.g., the increase in spreading rate with increasing roughness and the frequent appearance of apparent contact angles significantly different from equilibrium contact angles are discussed.
Dissert. Abstr.

N80-12308 Utah Univ., Salt Lake City.
PRESSURE DROP AND HEAT TRANSFER IN COCURRENT DOWNFLOW OF GAS-SOLIDS SUSPENSIONS Ph.D. Thesis

Jai Myung Kim 1979 234 p
Avail: Univ. Microfilms Order No. 7924316

Pressure drop and heat transfer of a gas-solids suspension flowing cocurrently downward in a 0.51 inch inside diameter tube were investigated using 329 micron spherical glass beads in air. For studying the fluid mechanics, experimental data were obtained on total pressure drop and particle holdup in the fully developed region. Pressure drop profiles along the entire distance of the tube were also measured at various solids loadings for three different gas Reynolds numbers. Experimental data for the heat transfer study consisted of local wall temperatures, measured at 16 locations along the axial distance of the heated tube, with uniform heat flux boundary conditions obtained by electrical power. Friction factors and Nusselt numbers were also obtained. Dissert. Abstr.

N80-12309 Wisconsin Univ. - Madison.
VISCOELASTIC RADIAL FLOW BETWEEN PARALLEL DISKS Ph.D. Thesis
Alberto Co 1979 365 p
Avail: Univ. Microfilms Order No. 7918147

The rheological model presented is a modified Zaremba-Fromm-DeWitt (MZFD) model, which has six adjustable parameters. The model parameters are obtained from experimental data for the viscosity and the primary normal stress coefficient. In sudden inception of steady shear flow, the model predicts stress overshoot but exhibits damped oscillations about the steady-state value. For elongational viscosity, the model gives the Newtonian prediction at low elongational rate; at higher elongational rate, the predicted elongational viscosity decreases and then increases with increasing elongational rate. It is concluded that more experimental data on material functions would have to be available before proper assessment can be made of the appropriateness of the MZFD model; and more extensive experimental studies on the radial flow system need to be taken. Dissert. Abstr.

N80-12310 Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTIONS TO FLUID MECHANICS AND BALLISTICS [BEITRAEGE ZUR STROEMUNGSFORSCHUNG UND ZUR BALLISTIK]
1979 109 p refs In GERMAN; ENGLISH summary (BMVG-FBWT-79-3) Avail: Issuing Activity

Measurement and data acquisition systems for gas flows and ballistics are discussed. Specific topics covered include velocity measurements on supersonic jets in hot envelopes and propellant gases, measuring the length of coherent structures in subsonic free jets, digital data acquisition systems for laser Doppler anemometers, miniaturized ballistic missile data acquisition systems, and measurements and data transmission in interior ballistics. For individual titles, see N80-12311 through N80-12316.

N80-12311 Institut Franco-Allemand de Recherches, St. Louis (France).
VELOCITY MEASUREMENTS ON PROPELLANT GASES IN GUN TUBES
H. Mach *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 2-14 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

Streak photography and a laser velocimeter technique were tested in order to see whether they were suitable methods for velocity measurements on highly absorbing powder gas flows in gun barrel tubes. Preliminary results are presented and compared. It is concluded that while streak photography provides mean velocity values of layers at specific depths, the laser velocimeter technique allows velocity profiles to be obtained over the whole barrel cross section. Author (ESA)

N80-12312 Institut Franco-Allemand de Recherches, St. Louis (France).
LASER ANEMOMETER MEASUREMENTS IN A SUPERSONIC FREE JET WITH A HOT GASEOUS ENVELOPE
H. J. Schaefer *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 15-33 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Acitivity

The flow processes taking place in a flame torch were investigated. An LDA technique was employed to measure the mean flow velocity (V) and turbulence intensity (tau) of a commerically available instrument. This technique is described and specific problems encountered with hot flows are discussed. The accuracies achieved for the mean V and Tau measurements were approximately 2% and 10% respectively. The considerable influence of the hot envelope on the central flow is seen in the profile measurements given. Author (ESA)

N80-12313 Institut Franco-Allemand de Recherches, St. Louis (France).
DIMENSIONS OF A COHERENT STRUCTURE IN THE POTENTIAL CONE OF A SUBSONIC FREE JET
H. J. Pfeifer *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 34-49 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The axially parallel length of a coherent structure in the potential cone was measured as a function of the distance from the 80 mm nozzle of a subsonic free jet escaping into the atmosphere at 100 meters/sec. Measurements were made with a laser anemometer in such a way as to avoid flow perturbation. In the flow region investigated, the greatest length of the structure was found to exceed one nozzle diameter, while the smallest length observed was two thirds of this diameter. Author (ESA)

N80-12314 Institut Franco-Allemand de Recherches, St. Louis (France).
DIGITAL DATA ACQUISITION SYSTEMS FOR LASER-DOPPLER-ANEMOMETRY: PROBLEMS AND DEVELOPMENTS DEMONSTRATED WITH THE AID OF INSTRUMENTS BUILT-UP AT THE ISL
M. Koenig *In its* Contrib. in Fluid Mech. and Ballistics 1979 p 50-68 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The nature of the photomultiplier signal fed into the system is discussed together with the methods and criteria employed to select and measure high frequency signals over a few cycles. The functions of the corresponding signal validification circuit are described. Emphasis is placed on the interpretation and accuracy of the results obtained and their subsequent treatment (minicomputer, printed readout). Some particle velocity and turbulence measurements are presented. Author (ESA)

N80-12315 Institut Franco-Allemand de Recherches, St. Louis (France).
DATA ACQUISITION AND TRANSMISSION FROM HIGHLY ACCELERATED BALLISTIC MISSILES OF SMALL AND MEDIUM CALIBRE
G. Schultze *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 69-87 refs In GERMAN; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The use of miniaturized sensors and transmission systems in the development of weapon systems is discussed. The sensors withstand extremely high accelerations and are manufactured by thick film techniques on ceramic substrates. The properties, characteristics, and manufacturing problems encountered with single and multichannel measuring systems are described. A few examples are presented showing how practical ballistic telemetric measuring systems are used. Author (ESA)

N80-12316 Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENTS IN INTERIOR BALLISTICS, TRANSMISSION, SENSORS
P. Rateau *In its* Contrib. to Fluid Mech. and Ballistics 1979 p 88-101 refs In FRENCH; ENGLISH summary (For primary document see N80-12310 03-34)
Avail: Issuing Activity

The study of moving projectiles in interior ballistics led to the development of systems in which signals could be transmitted from probes under severe conditions of acceleration, pressure, and temperature. Various transmission techniques (e.g. microwaves, optoelectronic devices, conducting wires, storage devices) are briefly described, as are inductive transducers for

measuring pressure, axial accelerations, and transverse vibrations to which the projectile is subjected. The technique best adopted to specific projectile systems is indicated. Author (ESA)

N80-12317# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PREDICTION METHODS FOR TURBULENT FLOWS
1979 509 p refs Lecture held at Rhode-Saint-Genese, Belgium, 15-19 Jan. 1979
(VKI-Lec-Ser-1979-2) Avail: NTIS HC A22/MF A01

Recent advances in the development of prediction models for turbulent flows are reported and their application to various problems of industrial and geophysical interest is discussed. Particular emphasis is given to second order closure models and turbulent combustion. For individual titles, see N80-12318 through N80-12324.

N80-12318# Cornell Univ., Ithaca, N. Y.
SECOND ORDER MODELING OF TURBULENT FLOWS
J. L. Lumley *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 26 p refs Sponsored in part by Office of Naval Research (For primary document see N80-12317 03-34)
(Grant NSF ATM-77-22903)
Avail: NTIS HC A22/MF A01

Equations for the first and second order quantities (the variances and fluxes) are formed and the third order terms that appear in these equations are modeled in terms of the first and second order quantities. The equations for the second order quantities are usually supplemented by one or more equations for something equivalent to a length scale. The resulting set of equations is then solved on a computer by time-stepping. Second order modeling should be contrasted with the mixing length approach, which could be called first order modeling. Flaws in the mixing length approach are reviewed as well as the cost of using second order models. A.R.H.

N80-12319# Karlsruhe Univ. (West Germany).
TURBULENCE MODELS FOR ENVIRONMENTAL PROBLEMS
W. Rodi *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 89 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Various models for describing the turbulent transport of momentum, heat and mass in environmental flows are presented. The merits and demerits of the individual models are discussed with respect to their predictive ability, their computational economy and the ease with which they can be used in practical calculations. Examples are presented of model applications to various flow situations relevant to environmental problems, most of them being examples from the water environment. The two-equation models employing differential transport equations for the velocity and length scales of the fluctuating motion are sufficiently complex for most practical calculations. In particular, the k - epsilon model is shown to predict reasonably well a fairly large range of problems with the same empirical input. In shear-layer situations where the length scale can be specified empirically, energy one-equation models are judged to work equally well; when history and transport effects on the turbulence are unimportant, the mixing length hypothesis can also be used. The most complex models included, which employ transport equations for the individual turbulent stresses and heat or mass fluxes, are conceptually superior, but there is no evidence that the increased computational effort they require is justified for most problems. A.R.H.

N80-12320# Kernforschungszentrum, Karlsruhe (West Germany).
DIRECT NUMERICAL SIMULATION OF TURBULENCE
U. Schumann, G. Groetzbach, and L. Kleiser *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 140 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Methods for direct numerical simulation of turbulent incompressible flows - sometimes called large-eddy simulations are reviewed and various results of applications are presented which show the usefulness and limitations of these methods. Both finite difference methods and spectral methods are described. For high Reynolds numbers the idea of sub-grid scale models is explained. The turbulence problem is tackled as far as possible from first principles. The Navier-Stokes equations are viewed as the simplest turbulence theory. A.R.H.

N80-12321# Ecole Centrale de Lyon (France).
PATHOLOGICAL CASES IN TURBULENT FIELD AND SPECTRAL APPROACH
J. Mathieu and D. Jaendel *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 59 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Pathological cases, which are defined by reference to standard patterns of flows, the mechanisms of which can supposedly be elucidated, display some failures in previous predictive methods. The role played by several preponderant factors which appear in the equations governing either the evolution of the turbulent kinetic energy or that of the velocity correlation is more or less explained. Mean velocity gradient orders the turbulent structure whereas the rate of strain pressure correlation refrains this trends. Such views can be supported by experimental data; however, if the behavior of some turbulent fields is examined, slight failures appear. In several cases, the reasons of such failures can be found by analyzing the spectral behavior of these turbulent fields. In most cases, the energy flux is constant within the inertial range, all the parts of the spectrum are linked to each other through this scalar quantity. Such a situation can be invalidated if a large amount of energy is introduced in a small spectral area. This peak in spectral space displays the important role of quasi ordered structures; hence, turbulence modellings carried out in physical space should be invalidated unless several characteristic scales are introduced. A.R.H.

N80-12322# Liege Univ. (Belgium).
THE APPLICATION OF TURBULENCE MODELS TO GEOPHYSICAL FLOWS: TURBULENCE IN THE OCEAN
Jacques C. J. Nihoul *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 26 p refs Prepared in cooperation with Louvain Univ., Belgium (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Topics covered include (1) basic equations of ocean hydrodynamics; (2) time scales, length scales, and linear wave theory; (3) dispersions bands in the ocean - macroscale and mesoscale waves; (4) interaction band in the ocean; (5) turbulent windows in the w-k plane; (6) spectrum of turbulence and the energy cascade; (7) averaging and parameterization of unresolved motions; and (8) boundary turbulence. A.R.H.

N80-12323# Imperial Coll. of Science and Technology, London (England).
MODELS FOR TURBULENT FLOWS WITH VARIABLE DENSITY AND COMBUSTION
W. P. Jones *In* Von Karman Inst. for Fluid Dyn. Prediction Methods for Turbulent Flows 1979 37 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

The accurate calculation of the fields of velocity, concentration of the major species and pollutants and temperature in such systems as industrial furnaces, gas turbine combustors and i.c. engine combustion chambers introduces a myriad of additional problems over and above those already present in inert turbulent flows. The central (unresolved) difficulty in devising prediction methods for reacting flows revolves around the problem of evaluating mean reaction rates. For this reason, rather than attempt to model features in their full complexity, attention is restricted to relatively simple flames. The flows considered are high Reynolds number, single phase, turbulent, high temperature flames in which radiative heat transfer can be considered negligible. Consideration of soot and particulate formation and consumption is omitted as are liquid and solid fuelled flames, fuel pyrolysis and ignition and extinction phenomena. A.R.H.

N80-12324# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MODELS OF TURBULENT COMBUSTION FOR NUMERICAL PREDICTIONS
Roland Borghi *In* Von Karman Inst. for Fluid Dyn. Prediction

Methods for Turbulent Flows 1979 36 p refs (For primary document see N80-12317 03-34)
Avail: NTIS HC A22/MF A01

Progress in the theoretical prediction of turbulent combustion was advanced by the development of calculation models and methods for turbulent non reactive flows, as well as by the use of probability density functions (p.d.f.) of the fluctuations. Studies reviewed concern the usefulness of the p.d.f. for reactive turbulent mixtures, the general properties of this p.d.f., and their exact calculation by a new balance equation, and an approximate hybrid method that seems to be of practical use. Comparisons with measurements inside a turbulent premixed flame are presented and discussed. A.R.H.

N80-12325# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNSTEADY FLOW IN TURBOMACHINES, VOLUME 1
2 Feb. 1979 454 p refs Lecture held at Rhode-Saint-Genese, Belgium, 29 Jan. - 2 Feb. 1979
(VKI-Lec-Ser-1979-3-Vol-1) Avail: NTIS HC A20/MF A01

The fluid mechanical aspects of unsteady flow in axial compressors were studied. For individual titles, see N80-12326 through N80-12330.

N80-12326# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
INTRODUCTION TO UNSTEADY FLOWS IN TURBOMACHINES
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 43 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

The basic fluid mechanic aspects of unsteady flow in turbomachines are discussed. The unsteadiness is seen to arise from several different sources, and to have an impact on the overall behavior of the machine. The topics covered are: (1) basic consideration of unsteady flow and inherent unsteadiness of turbomachinery, (2) sources of unsteady flows and relevant parameters, (3) illustrative examples of unsteady flow, (4) unsteady effects with uniform inlet flow, and unsteady effects with nonuniform flow (inlet distortion). F.O.S.

N80-12327# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
INLET DISTORTION EFFECTS IN AXIAL COMPRESSORS
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 60 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

Methods for predicting compressor response to inlet distortion are discussed. The emphasis is on those approaches which have proved most useful in analyzing circumferentially nonuniform flows in multistage compressors (as opposed to isolated rotors or single stages). Attention is focussed on the basic fluid mechanic concepts which underlie these methods in order to develop a clear physical understanding of the flow fields under consideration. Material on the parallel compressor model, unsteady and two-dimensional effects of inlet distortion, compressor/component coupling in asymmetric flows, and some discussion of the prediction of compressor stall with distorted inlet flows are included. F.O.S.

N80-12328# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
ROTATING STALL AND SURGE IN AXIAL COMPRESSORS
Edward M. Greitzer *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 27 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

The basic features of the instabilities that are associated with axial flow compression systems are described. The two different modes of instability, rotating stall and surge, are defined and criteria are presented for determining their onset. The phenomena that occur subsequent to this onset are discussed, and methods are presented for predicting the large amplitude transients that characterize post-stall behavior in multistage compressors. The impact of the two different modes on system recovery from stall is then discussed, and a technique is presented for predicting the performance of multistage compressors in rotating stall, with particular reference to the stall/unstall hysteresis behavior. F.O.S.

N80-12329# Iowa State Univ. of Science and Technology, Ames.
TURBOMACHINE WAKE TRANSPORT AND INTERACTION
T. H. Okiishi *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 183 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

Several simplified turbomachine configurations are sketched in to illustrate the kinds of wake interactions that are considered. Only low-speed effects are discussed. The modeling of a first row rotor or stator wake is reviewed and the chopping and subsequent transport of chopped wake segments by a downstream row are discussed. The effects of chopped wake segment influence on second and third row rotor or stator flows are considered. Finally, several kinds of interaction effect examples are discussed. F.O.S.

N80-12330# Liege Univ. (Belgium).
STEADY PRESSURE DISTORTIONS
J. Colpin and P. VanWambeke *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 1 2 Feb. 1979 47 p refs (For primary document see N80-12325 03-34)
Avail: NTIS HC A20/MF A01

A unified approach based on the analysis of the compressor rotor dynamic transfer with distorted inflow is presented. A simple flow model was formulated and analyzed to illustrate the factors affecting the dynamic response of the rotor. It is shown that a high peripheral velocity and a large chord is beneficial for the distortion attenuation. F.O.S.

N80-12331# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNSTEADY FLOW IN TURBOMACHINES, VOLUME 2
2 Feb. 1979 349 p refs Lecture held at Rhode-Saint-Genese, Belgium, 29 Jan. - 2 Feb. 1979
(VKI-Lec-Ser-1979-3-Vol-2) Avail: NTIS HC A15/MF A01

Problems associated with unsteady flow in turbocompressors are discussed. Specific topics covered include temperature distortion and unsteady pressure distortion in compressor inflows, flow measurements in a rotating stall cell, temperature effects in blade-wake interference, high speed blade-wake interactions, and rotor stall in axial flow compressors. For individual titles, see N80-12332 through N80-12337.

N80-12332# Cranfield Inst. of Tech., Bedfordshire (England).
TEMPERATURE DISTORTION
R. E. Peacock *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 31 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Mathematical models for compressors subject to temperature distorted inflow are presented along with supporting experimental evidence. A time lag term is added to the parallel compressor hypothesis to predict the stability line for a compressor and the characteristics in distorted flow. In addition, the detailed flow around the airfoils is examined to create a model which accounts for the effects of distortion on the airfoils as well as the effects of the airfoils on distortion. K.L.

N80-12333# Cranfield Inst. of Tech., Bedfordshire (England).
UNSTEADY PRESSURE DISTORTION
R. E. Peacock *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 26 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

A model is proposed for the solution of unsteady flows in a compressor embedded in ductwork and subjected to repetitive or nonrepetitive pulses. Various methods for generating the unsteady pulses are discussed. A three-stage aircraft type compressor was subjected to pulsating flows in order to determine experimentally the effects of pulsating flow on compressor performance. K.L.

N80-12334# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLOW MEASUREMENTS IN A ROTATING STALL CELL
F. A. E. Breugelmans *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 23 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

The cell structure in a low speed single stage compressor model is investigated for various stagger angles. The observations are compared to predictions based on two theories and to results of experiments with a three stage model. K.L.

N80-12335# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
BLADE WAKE INTERFERENCE: TEMPERATURE EFFECT
F. A. E. Breugelmans *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 14 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Wake motion through the mean section of a NACA 65 series rotor and cascade blading was investigated. Cascade flow was studied using a stationary wake generator and compared to a moving generator where temperature effects existed. The rotor configuration was investigated using the hot wire sampling technique at different overheat ratios and hot wire orientations. K.L.

N80-12336# Technische Hochschule, Aachen (West Germany).
HIGH SPEED BLADE-WAKE INTERACTIONS
H. E. Gallus *In* Von Karman Inst. for Fluid Dyn. Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 46 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Measurements were conducted on single stage turbomachines in order to explore the dependency of wake production, transport, and interaction on the main geometric and aerodynamic parameters of subsonic and supersonic axial flow turbomachines. Some of the results are compared with numerical results from simplified theoretical approaches. K.L.

N80-12337# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ROTATING STALL IN AXIAL FLOW COMPRESSORS
N. Omer *In its* Unsteady Flow in Turbomachines, Vol. 2 2 Feb. 1979 34 p refs (For primary document see N80-12331 03-34)
Avail: NTIS HC A15/MF A01

Some of the methods used to predict rotating stall or its characteristics are described. Predictions obtained using these methods are compared to experimental data obtained from four different single stage axial compressors, and their reliability is discussed. A nonlinear method is proposed to calculate rotating stall inception and characteristics in a quasi-three-dimensional compressible flow of a one stage or multistage axial flow compressor. The suitability of such a method for the solution of industrial problems is discussed and the missing experimental data for its improvement are identified. K.L.

N80-12338# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 1
1979 433 p Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979
(VKI-Lec-Ser-1979-4-Vol-1) Avail: NTIS HC A19/MF A01

The use of porous media in connection with energy storage or exchange is considered. Heat storage and transfer in packed beds, regenerators, moving bed heat exchangers, and natural convection in porous media are among the topics covered. Application to geothermics and solar energy is emphasized. For individual titles, see N80-12339 through N80-12345.

N80-12339# Karlsruhe Univ. (West Germany).
TRANSPORT PHENOMENA IN PACKED BED REACTORS
E. U. Schluender *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-27 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Transport phenomena in the voids between the particles of packed bed reactors are treated. Topics covered include: (1) hydraulic properties; (2) heat and mass transfer between the fluid and the particles; and (3) radial transport of heat and mass through the voids and the particles. J.M.S.

N80-12340# Michigan Univ., Ann Arbor. Heat Transfer Lab.
SURVEY AND DESCRIPTION OF TRANSPORT PHENOMENA IN PACKED-BEDS
John A. Clark *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-21 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

A brief review of the literature pertaining to transport properties in packed beds, particulary as they apply to storage of thermal energy derived from solar energy conversion systems, is presented. Geometric and design parameters that influence the thermal and flow performance of a packed bed are discussed along with analytical models established to simulate the dynamic behavior of the bed. Single and two phase models are included. J.M.S.

N80-12341# Michigan Univ., Ann Arbor. Heat Transfer Lab.
DYNAMIC RESPONSE OF A PACKED-BED ENERGY STORAGE SYSTEM TO A TIME VARYING INLET TEMPERATURE
In Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-7 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

An analytical method for determining the response of a rock-bed energy storage system to temperature variations is outlined. Emphasis is on the case in which the inlet air temperature feeding the bed varies arbitrarily with time, a condition commonly expected in a solar energy supply system. J.M.S.

N80-12342# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
HEAT STORAGE AND THERMAL TRANSFER ASPECTS OF THE DYNAMIC BEHAVIOUR OF A PACKED BED
John A. Clark and Ronald L. Nabozny *In* von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-12 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

The formulation of the dynamic response and thermal storage capacity of a packed bed storage unit for solar energy application is outlined for both the charging and recovery modes. Owing to the limitations of analytical procedures, the solutions to this problem are given in terms of an implicit, finite difference numerical formulation. The computer program for this solution is called ROCKBED. Comparison between the numerical results and those from experiment indicate the importance of improved knowledge of certain empirical data for pack beds, including heat transfer coefficients, effective particle size, void fraction, and wetted area per unit volume. J.M.S.

N80-12343# Michigan Univ., Ann Arbor. Heat Transfer Lab.
HEAT TRANSFER IN A COLUMN PACKED WITH SPHERES
Chris D. VandenBroek and John A. Clark *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-17 refs (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Average and local surface-heat transfer coefficients in a cylinder packed with spheres are investigated. The term 'local' applies to a single sphere within the bed. Averages are derived from the sixteen different spheres that are instrumented and distributed throughout the bed. The experimental technique consists of introducing a step change in temperature to the air flowing through the bed and recording the resulting air and ball temperature transients within the bed over a range of Reynolds numbers. An overall correlation of heat transfer with Reynolds number is derived and compared to others available in the literature. Patterns observed in the local coefficients are discussed. The experimental results are compared with analytical and numerical models. J.M.S.

N80-12344# Bureau de Recherches Geologiques et Minieres, Orleans (France).
TRANSPORT PHENOMENA IN GEOLOGICAL LAYERS MEASUREMENT OF PARAMETERS
J. P. Sauty *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-4 (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

The physics of mass transfer in aquifers is considered in terms of ground water pollution. Mathematical models for the numerical integration of the mass transfer equations are reviewed. Techniques discussed include finite difference, variational methods, and methods of characteristics. In situ tracer tests to determine dispersion and convection velocity are discussed including some conclusions resulting from such tests. J.M.S.

N80-12345# Bureau de Recherches Geologiques et Minieres, Orleans (France).
APPLICATION OF POROUS MEDIA TO HEAT STORAGE UNDERGROUND
J. P. Sauty *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 1 1979 p 1-5 (For primary document see N80-12338 03-34)
Avail: NTIS HC A19/MF A01

Two types of underground heat storage are described: a dry bed and an aquifer. It is shown that the aquifer provides the more efficient heat transfer by forced convection. Heat storage in a single well and in two twin wells is discussed. J.M.S.

N80-12346# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FLUID DYNAMICS OF POROUS MEDIA IN ENERGY APPLICATIONS, VOLUME 2
1979 402 p refs Lecture held at Rhode-Saint-Genese, Belgium, 12-16 Feb. 1979
(VKI-Lec-Ser-1979-4-Vol-2) Avail: NTIS HC A18/MF A01

Topics are presented on heat exchangers, heat exchange processes, the post accident heat removal from a liquid metal fast breeder reactor, the influence of an obstruction on a fluid particle heat transfer, a fluorescence method for the local voidage in random packed beds, and the application of packed beds to energy storage use of latent heat of fusion. For individual titles, see N80-12347 through N80-12353.

N80-12347# Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk (Netherlands).
FUNDAMENTALS OF REGENERATORS
J. Brasz *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 25 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The principal mechanisms of the regenerative heat exchangers are presented. Some of the analytical solutions of the start of the regenerators operation (the so called single blow problem) are dealt with, and some approximative numerical and graphical methods are described. The continuous operation of the regenerators is explained by means of some calculated temperature responses. M.M.M.

N80-12348# Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk (Netherlands).
MODELLING AND SIMULATION OF A MOVING-BED HEAT-EXCHANGE PROCESS
J. Brasz *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 36 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

More practicable simulation methods for the dynamic behavior of moving packed bed heat exchange processes are described. A pellet indurating plant which is a moving grated unit is analyzed to demonstrate the dynamic response of the cross flow heat exchangers. M.M.M.

N80-12349# Commissariat a l'Energie Atomique, Cadarache (France).
GENERAL AND PARTICULAR ASPECTS OF THE PARTICULATE BED BEHAVIOUR IN THE POST ACCIDENT HEAT REMOVAL SITUATION FOR LIQUID METAL FAST BREEDER REACTORS
C. Joly (Laboratories du Centre d'Etude del Energie Nucleaire, Mol, Belgium) and C. LeRigoleur *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 77 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The particular P.A.H.R. (post accident heat removal) situation for liquid metal fast breeder reactor) whose coolant is sodium is presented. This situation mainly results from the formation of a fine particulate bed internally heated by decay of fission products. The essential safety problem is to know the heat removal capability of such a bed when surrounded by stagnant sodium. Topics discussed are: (1) the formation of the particulate bed and its characteristics; (2) the possibilities of out-of-pile and in-pile simulation of the P.A.H.R. problem; and (3) the basic theoretical approaches of the P.A.H.R. problem. M.M.M.

N80-12350# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
INFLUENCE OF AN OBSTRUCTION ON FLUID-PARTICLE HEAT-TRANSFER IN A PACKED BED
C. Joly *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 20 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

The influence of a local obstruction on heat transfer between one particle in a packed bed and the coolant gas which is forced through it is presented. A method is developed, giving average as well as local heat transfer coefficients in the case of a packed bed containing spherical particles of constant diameter. Typical obstructions which can form inside a packed bed are then defined and heat transfer perturbations in the vicinity of such obstructions are measured. The results show (1) an important decrease of the average cooling of a sphere near the obstruction. The measurements are correlated by an expression such as $Nu = A.Re^{B}$ where Nu is the Nusselt number, Re the Reynolds number and A, B constants depending upon the type and the amount of obstruction; (2) important local variations of the heat transfer coefficient over the surface of a sphere; and (3) rapid attenuation of the perturbation in the upward and downward directions. M.M.M.

N80-12351# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HOT SPOT PHENOMENA IN ACTIVE PACKED BEDS
J-M Buchlin *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 61 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A study of the hot spot formation in random packed beds of active spherical particles is presented. Two causes of temperature peak development are envisaged: the local variation of the porosity in the random packing; and the presence of obstructions. The first cause is analyzed experimentally and theoretically. Thermal nonuniformities are located in the peripheral region of the fixed bed. The disturbing effects of obstructions in the active bed are theoretically simulated. The complex nature of the resulting velocity and temperature fields are emphasized. M.M.M.

N80-12352# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A FLUORESCENCE METHOD FOR THE MEASUREMENT OF THE LOCAL VOIDAGE IN RANDOM PACKED BEDS
J-M Buchlin, M. Riethmuller, and J. J. Ginoux *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 9 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A technique enabling the visualization of the internal structure of a randomly packed bed and likewise the void fraction distribution measurement by photoelectric process is presented. The method is based on the light reemission of a fluorescent liquid, filling the interstices of the packing and excited by a laser source. It requires the matching of the refractive indexes of the packed bed components. Preliminary tests are presented to illustrate the principle of the method. M.M.M.

N80-12353# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
APPLICATION OF PACKED BEDS TO ENERGY STORAGE USE OF LATENT HEAT OF FUSION
J.-M. Buchlin and P. H. Theunissen *In* Von Karman Inst. for Fluid Dyn. Fluid Dyn. of Porous Media in Energy Appl., Vol. 2 1979 15 p refs (For primary document see N80-12346 03-34)
Avail: NTIS HC A18/MF A01

A design of thermal storage unit based on the use of latent heat in packed beds is presented. A theoretical model is described of the unsteady heat transfer in such pile where the particles are formed by heat of fusion material incapsulated in spherical containers. The temperature distributions of the circulating fluid and of the phase change material as well as the rate of melting are obtained by numerical procedure. The theoretical predictions are validated in comparison with experimental results. M.M.M.

N80-12354# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
DATA ACQUISITION SYSTEMS AND DATA ANALYSIS IN FLUID DYNAMICS
1979 230 p refs Lecture held at Rhode Saint Genese, Belgium, 26 Feb. - 2 Mar. 1979
(VKI-Lec-Ser-1979-5) Avail: NTIS HC A11/MF A01

Theoretical fundamentals of data acquisition and analysis are discussed along with the design and applications of interactive data acquisition systems. For individual titles, see N80-12355 through N80-12357.

N80-12355# Radio Corp. of America, Moorestown, N. J.
DIGITAL SIGNAL ANALYSIS: THEORY AND APPLICATIONS
Louis Shapiro *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 92 p *ref* (For primary document see N80-12354 03-34)
Avail: NTIS HC A11/MF A01

The benefits of using digital methods for handling information are considered. The sampling theory, spectral analysis and correlation, digital filters, and data transmission are discussed. F.O.S.

N80-12356*# Southampton Univ. (England).
APPLICATION OF DATA ACQUISITION SYSTEMS FOR ON-LINE DEFINITION AND CONTROL OF WIND TUNNEL SHAPE
S. W. D. Wolf *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 46 p refs (For primary document see N80-12354 03-34)
(Grant NsG-7172)
Avail: NTIS HC A11/MF A01

Improvements in wind tunnel design to reduce test and flight discrepancies are analyzed. Flexible wall streamlining, criteria for tunnel streamlining, and error assessment are discussed. It is concluded that the concept of self-streamlining wind tunnels is suited for on-line computer control. F.O.S.

N80-12357# Electricite de France, Chatou.
APPLICATION OF DATA ACQUISITION SYSTEM FOR ON SITE MEASUREMENTS OF WIND EFFECTS ON STRUCTURES
J. F. Sageau and M. Hamonou *In* Von Karman Inst. for Fluid Dyn. Data Acquisition Systems and Data Analysis in Fluid Dyn. 1979 26 p refs (For primary document see N80-12354 03-34)
Avail: NTIS HC A11/MF A01

Problems specific to in situ acquisition of measurements are discussed along with the typical data acquisition chain used at present for in situ measurement of pressure fields at the surface of large structures. F.O.S.

N80-12358# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS
1979 263 p refs Lecture held at Rhode-Saint-Genese, Belgium, 19-23 Mar. 1979
(VKI-Lec-Ser-1979-6) Avail: NTIS HC A12/MF A01

Recent advances in the theory and application of numerical methods to solve complex problems of fluid mechanics are described. Particular emphasis is given to the treatment of moving boundaries and surface problems and recent progress in solving hyperbolic equations. For individual titles, see N80-12359 through N80-12364.

N80-12359# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
NUMERICAL METHODS FOR HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
H. O. Kreiss *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 42 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The theory and numerical solution of hyperbolic partial differential equations is presented. Only linear problems are considered. R.E.S.

N80-12360# College de France, Paris.
SOME ASPECTS OF THE APPROXIMATION OF FREE SURFACE PROBLEMS
J. L. Lions *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 35 p refs Prepared in cooperation with Institut de Recherche d'Informatique et d'Automatisme (France) (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The following aspects concerning free surface problems are discussed: (1) the obstacle problem, (2) homographic penalty, (3) variational inequalities, (4) standard penalty methods, (5) Bingham flows, and (6) free surfaces in composite materials. R.E.S.

N80-12361# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
ORDER OF ACCURACY AND BOUNDARY CONDITIONS FOR LARGE SCALE TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
Eli Turkel *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 46 p refs (For primary document see N80-12358 03-34)
(Grant EY-76-C-02-3077)
Avail: NTIS HC A12/MF A01

The factors that influence the choice of a scheme in the construction of numerical solutions are discussed. Special attention is paid to the treatment of boundaries--standard, moving, and artificial. In all cases, the interplay between the physics and the numerics is stressed. R.E.S.

N80-12362# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE COMPUTATION OF THREE DIMENSIONAL VISCOUS FLOWS
Egon Krause (Aerodynamisches Institut, RWTH Aachen, Germany) *In its* Computational Fluid Dyn. 1979 26 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

A method is presented for calculating the unsteady three dimensional incompressible flows in vessels with time and space dependent cross sections. The equations for the motion of the flow are writen for a generalized, non-orthogonal coordinate system. The finite difference equations are obtained by applying Gauss' divergence theorem to a volume element bounded by coordinate surfaces. The governing equations are solved in a simultaneous iteration process for velocity and pressure. A new matching technique for connecting hybrid mesh systems is described and the treatment of elastic walls is discussed. The formation of Taylor-Gortler cells in spherical gaps is discussed. Only axially symmetric flows are considered so that the stream-function-vorticity-formulation can be used. It is shown how the boundary conditions chosen influence the finite-difference solution. If the space and time resolution is not sufficiently fine, the finite difference approximation converges to a solution belonging to different boundary conditions. R.E.S.

N80-12363# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ON SOME PROBLEMS IN TWO AND SINGLE PHASE FLOWS
H. J. Wirz *In its* Computational Fluid Dyn. 1979 26 p refs

(For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The mathematical problem for extracting the relevant parameters that describe the bulk properties of heterogeneous flows is discussed for two limiting cases: (1) equipresent phases are nearly independent of each other; and (2) multi-phase material behaves statistically as a homogeneous material. Systems of partial differential equations are used as mathematical models. R.E.S.

N80-12364# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
THE NUMERICAL TREATMENT OF COMPRESSIBLE HIGH REYNOLDS NUMBER FLOWS
H. Hollanders and H. Viviand *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn. 1979 66 p refs (For primary document see N80-12358 03-34)
Avail: NTIS HC A12/MF A01

The case of compressible flows at high Reynolds numbers, such as flows of current interest in transonic or supersonic aerodynamics is considered. Problems relating to the numerical calculation of such flows, in the case when the influence of viscous effects is more or less strongly felt in the whole flow field, and not just in a small part of the flow field are described. The 'global approach', a method for solving interaction problems based on the coupled calculation of the solutions in the inviscid flow region and in the viscous layer, is presented. R.E.S.

N80-12365# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
APPLICATION OF NUMERICAL METHODS TO FLOW CALCULATIONS IN TURBOMACHINES
1979 480 p Lecture held at Rhode-Saint-Genese, Belgium, 23-27 Apr. 1979
(VKI-Lec-Ser-1979-7) Avail: NTIS HC A21/MF A01

A review of the application of numerical methods to flows in turbomachines is presented. Calculation techniques in which the partial differential equations are solved using finite difference, finite volume, and finite element methods are described. The fundamental equations of fluid mechanics and their properties are discussed. The calculation of two dimensional and three dimensional subsonic and transonic flows is examined. The computational aspects of viscous internal flows are reported. The merits of the various calculation methods are assessed by comparison with experimental data. For individual titles, see N80-12366 through N80-12371.

N80-12366# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO NUMERICAL METHODS: MATHEMATICAL CONCEPTS AND FUNDAMENTAL EQUATIONS
W. Kollmann *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 22 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The development and the application of numerical methods to the basic mathematical concepts in fluid mechanics is discussed. The formulation of the problems arising in fluid mechanics into terms of partial differential equations, or partial differential systems, and a set of auxiliary conditions constituting a differential problem is examined. The solutions to the partial differential problems, solved by the numerical methods outlined, are described. A.W.H.

N80-12367# Vrije Universiteit, Brussels (Belgium).
FINITE ELEMENT CALCULATIONS OF TURBOMACHINERY FLOWS
C. Hirsch *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 78 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The finite element calculations of turbomachinery flows is presented. The different aspects in the application of the finite element method (FEM) and the finite difference method (FDM) are examined. An engineering presentation of the FEM is discussed in relation to turbomachinery flows and the different aspects of the FEM and the FDM are determined. Applications of the FEM to through flow calculations and to blade to blade subsonic flows are described. Quasi three dimensional and three dimensional methods are discussed and blade transonic flows are determined. A.W.H.

N80-12368# Stuttgart Univ. (West Germany).
DESIGN OF SUPERCRITICAL COMPRESSOR AND TURBINE CASCADES WITH A NUMERICAL METHOD CONSIDERING AXIAL VELOCITY DENSITY RATIO
E. Schmidt *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 49 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The development and application of a numerical design method for the design of two supercritical compressors and turbine cascades is presented. The use of the method to determine the blade contours from a given velocity distribution is discussed. The application of the numerical method for the computation of plane transonic flow field is described. An extension of the method which considers the variation of the axial velocity density ratio is discussed. A.W.H.

N80-12369# Cambridge Univ. (England).
TIME MARCHING METHODS FOR TURBOMACHINERY FLOW CALCULATION
J. D. Denton and U. K. Singh (GEC Power Engineering Ltd.) *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 47 p (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The time dependent methods used to solve flow calculation problems are discussed. The advantages and disadvantages of these methods are described. The applications of time dependent methods to turbomachinery flow problems are reported. The time dependent methods applied to two dimensional cascade flows, quasi three dimensional blade to blade flow, and three dimensional blade to blade flow are described. The development of time dependent methods for inviscid turbomachinery flow calculations is presented. A.W.H.

N80-12370# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TIME MARCHING METHODS FOR TURBOMACHINERY FLOW CALCULATIONS: METHODS OF IMPROVING CONVERGENCE
W. VanHove *In its* Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 38 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The time marching methods for the calculation of inviscid, transonic flows are examined. Several finite difference schemes for time marching methods, applied to the calculation of one dimensional, inviscid, transonic flow with shock through a convergent-divergent channel are described. The means to improve the convergence speed of a particular finite difference scheme are discussed. A one dimensional investigation, applied to the calculation of the inviscid, blade to blade flow in a transonic turbine cascade using a finite volume discretization method to discretize the flow domain is discussed. A.W.H.

N80-12371# Scientific Research Associates, Inc., Rockville, Md.
COMPUTATIONAL ASPECTS OF VISCOUS FLOWS
Henry McDonald *In* Von Karman Inst. for Fluid Dyn. Appl. of Numerical Methods to Flow Calculations in Turbomachines 1979 192 p refs (For primary document see N80-12365 03-34)
Avail: NTIS HC A21/MF A01

The computational aspects of viscous flows are presented. The relationship of the boundary layer equations to the Navier-Stokes Equations is discussed. A summary of the two and three dimensional conventions in boundary layer equations is presented. Four categories of three dimensional viscous flow prediction schemes are identified. A.W.H.

N80-12372*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A SIMPLIFIED MODEL FOR THE VISCOUS CROSSFLOW IN A SLOTTED TEST SECTION
Charlie H. Cooke Nov. 1979 27 p refs

(Grant NsG-1517)
(NASA-CR-3206) Avail: NTIS HC A03/MF A01 CSCL 20D

A simplified physical model was constructed which simulates the viscous crossflow in a fluid layer near the slots at a fixed streamwise location in a slotted wind tunnel. For low to moderate Reynolds numbers, numerical solutions of the two dimensional, incompressible Navier-Stokes equations in stream function and vorticity, which govern the model flow, were obtained. Fairly general slot geometry was incorporated by means of the Thompson-Thames-Mastin transformation. An approximate factorization scheme with cyclic acceleration parameters was employed to solve a finite difference analog of the stream function equation. The vorticity equation was numerically solved with a modified version of the classical alternating direction implicit scheme. Although no quantitative assessment of solution accuracy can be made, numerical results for variations in incremental wall pressure around the slat are at least qualitatively similar to some experimental results. R.E.S.

N80-12373# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

APPLICATIONS OF RANDOM-CHOICE METHOD TO PROBLEMS IN SHOCK AND DETONATION-WAVE DYNAMICS

T. Saito and I. I. Glass Oct. 1979 73 p refs
(UTIAS-240; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

Applications of the Random-Choice Method (RCM) are presented for the solution of problems in shock and detonation wave dynamics. It is shown that unlike other numerical methods, the RCM yields sharp fronted shocks and contact surfaces without resorting to artificial and perhaps erroneous means of predicting their locations. R.C.T.

N80-12374# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

IMPROVED FLOW VISUALIZATION BY WISE USE OF RESONANT REFRACTIVITY Final Report, 1 Mar. 1974 - 28 Feb. 1979

Daniel Bershader Jul. 1979 293 p refs
(Contract AF-AFOSR-2670-74; AF Proj. 2307)
(AD-A073074; AFOSR-79-0937TR) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report discusses the experimental and theoretical work carried out associated with the use of resonance refractivity to improve flow visualization. The principal accomplishment of the present study was to verify quantitatively the feasibility of using the near-resonance spectral region around the sodium D-lines for obtaining one-to-two order-of-magnitude increase in the sensitivity of refractive methods of flow visualization such as schlieren, interferometric and shadow techniques. It is in this near region of the line wings, typically a few angstrom from line center, that the trade-off between refraction and absorption is highly favorable to permit implementation of the method with an available tunable dye laser light source. Here, the refractivity is high enough to see sound waves, weak vortices, etc. The accomplishments included a combined theoretical and experimental analysis of the near-region refractive and absorptive profile taking into account both doppler and collision broadening. The latter feature included studies to optimize the choice of collision parameters for self-broadening (pure sodium vapor) and for heterogeneous broadening (sodium highly diluted by a carrier gas in a flow facility). Experiments with an interferometer-heat pipe arrangement using a tunable pulsed dye laser gave results which agreed with the analysis. The technique is now at the facility-design stage. GRA

N80-12375# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

COMPUTATION OF WATER WAVES

J. C. W. Rogers and S. Favin Jul. 1979 131 p refs
(Contract N00024-78-C-5384)
(AD-A072944; APL/JHU/TG-1325) Avail: NTIS HC A07/MF A01 CSCL 20/4

The report contains the numerical implementation of a theoretical algorithm that generalizes the Euler equations for irregular flows. The main features of the algorithm are described, and the relevant equations are summarized. The spatial region occupied by the fluid is then discretized, and the numerical quadrature of the theoretical algorithm's governing equations is effected. Computational results are given for the following hydrodynamic free-boundary problems: (a) the fall from rest of a liquid with a profoundly nonlinear initial free surface; (b) the motion from rest of a liquid whose initial free surface is only slightly removed from its equilibrium position, and (c) the collisions of streams of fluid with formation of a jet. A program listing is given in the appendix. GRA

N80-12376# United Technologies Research Center, East Hartford, Conn.

AN EXPERIMENTAL AND ANALYTICAL STUDY OF BOUNDARY LAYERS IN HIGHLY TURBULENT FREE-STREAMS Annual Report, 1 Jun. 1978 - 1 Jun. 1979

M. F. Blair Jul. 1979 72 p refs
(Contract F49620-78-C-0064; AF Proj. 2307)
(AD-A073006; UTRC/R78-914388-5; AFOSR-79-0936TR; AR-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

Experimental research has been conducted to determine the influence of free-stream turbulence on zero pressure gradient, incompressible, fully turbulent boundary layer flow. During this period convective heat transfer coefficients, boundary layer mean velocity and temperature profile and wall static pressure distribution data were obtained for two flow conditions of constant free-stream velocity and low free-stream turbulence intensity and for one flow condition of constant free-stream velocity and higher free-stream turbulence. Documentation of the free-stream turbulence for these flows is currently in progress. The conclusion reached from the low free-stream turbulence test results is that these data are in excellent agreement with classic two-dimensional, low free-stream turbulence, turbulent boundary layer correlations, thus establishing the absolute accuracy of the experiment. The data obtained for the higher free-stream turbulence test case indicates that free-stream turbulence does have a significant effect on fully turbulent boundary layer skin friction and heat transfer. A quantitative assessment of this influence will emerge as data obtained for additional free-stream turbulence levels and as the turbulence distributions are documented. GRA

N80-12377# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

A GENERALIZED BASE-FLOW ANALYSIS WITH INITIAL BOUNDARY-LAYER AND CHEMISTRY EFFECTS Final Report, 1 Oct. - 18 May 1979

John H. Fox Jul. 1979 117 p refs Prepared in cooperation with ARO, Inc., Tullahoma, Tenn.
(AD-A072683; AEDC-TR-79-46) Avail: NTIS HC A06/MF A01 CSCL 20/4

A general theory has been developed for the supersonic, turbulent, near-wake region behind bluff-based, two-dimensional and axially symmetric bodies in the presence of a coaxial, supersonic jet. This work is a generalization of the theory of H. H. Korst and his co-workers. The present theory includes the effects of the initial boundary layer, base bleed, total enthalpy and species differences, and equilibrium chemistry. The generalization was accomplished through the development of an analytical recompression model that obviates the requirement for a recompression factor; the development of a species distribution model for the mixing layers; and the use of a new spreading parameter for the axially symmetric problem. The theory shows good agreement with experiment for the classical, planar-backstep problem with both thin and very thick boundary layers. Good agreement is also shown with base flows behind axially symmetric bodies with a coaxial jet. GRA

N80-12378# Naval Research Lab., Washington, D. C.

NUMERICAL SIMULATION OF COLLAPSING TURBULENT WAKES: COMPARISON OF TURBULENCE CLOSURES AND NUMERICAL SCHEMES Interim Report

A. Wam-Varnas, S. A. Piacsek, G. Hain, and J. Block 22 Mar. 1979 36 p refs
(ARPA Order 2152)
(AD-A072143; AD-E000304; NRL-MR-3930) Avail: NTIS HC A03/MF A01 CSCL 20/4

The collapse of a partially mixed region generated by a prescribed amount of turbulence deposited on a linearly stratified

ambient ocean is studied numerically. Different turbulent closures such as first and second order are used to model the turbulent stresses. The resulting equations are solved numerically in a finite-difference formalism of the primitive form of the equations in a box region several times the size of the mixed region. The resulting maximum observed mean field velocities, densities, and turbulent energies in the fluid are obtained and cross-compared for different closures and numerical methods. GRA

N80-12379# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
CHEMICAL REACTIONS IN TURBULENT MIXING Final Technical Report, 1 Dec. 1975 - 14 Apr. 1979
H. W. Liepmann, G. L. Brown, P. E. Dimotakis, F. E. Marble, A. Roshko, and P. G. Saffman 19 Jul. 1979 297 p refs
(Contract F44620-76-C-0046; AF Proj. 2307)
(AD-A073746; GALCIT-151; AFOSR-79-0952TR) Avail: NTIS HC A13/MF A01 CSCL 20/4

The more important results and developments achieved as a direct result of this contract are as follows: A model for the calculation of turbulent flows was constructed which incorporates effects of Reynolds stress relaxation with the generation or destruction of turbulent energy by rotation. The model was verified by comparison with experiment. It was then used to predict the properties of isolated turbulent vortices and applied to the turbulent mixing layer, in particular to the formation and interaction of the organized structure in the mixing layer. An alternative approach to the mixing layer in which it is modelled by a rolling-up vortex sheet between fluids of different density has also been formulated. Calculations of strained flame elements for use in the coherent flame mode of H2, F combustion showed that only at very high strain rates was sufficient vibrational nonequilibrium produced to be of interest for a chemical laser. This result is reflected in the fact that only in the early portion of the jet, where strain rates are a maximum, does this vibrational nonequilibrium occur. Experimental results were obtained in a new facility and by a new technique for the amount of reaction product obtained between two chemically reacting aqueous streams. Results at high and low Reynolds number showed the dependence of the mixing on Reynolds number and Schmidt number. A transition Reynolds number region was found and the nature of the generation of small scale motions which dominate the formation of reaction product was explored. GRA

N80-12380# California Univ., Berkeley. Lawrence Berkeley Lab.
AIR-TO-AIR HEAT EXCHANGERS: SAVING ENERGY AND IMPROVING INDOOR AIR QUALITY
G. D. Roseme, C. D. Hollowell, A. Meier, A. Rosenfeld, and I. Turiel Jun. 1979 8 p refs Presented at the Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9381; CONF-791009-2) Avail: NTIS HC A02/MF A01

Some houses currently built have substantially reduced air infiltration rates to conserve heating and cooling energy use. Indoor air quality problems associated with this large reduction in ventilation air have become apparent. The use is described of mechanical ventilation, coupled with heat recovery devices in residential buildings, to maintain acceptable indoor air quality and conserve energy. Estimates of energy and peak power savings are given. DOE

N80-12381# Los Alamos Scientific Lab., N. Mex.
SIMPLIFIED SOLUTION ALGORITHMS FOR FLUID FLOW PROBLEMS
C. W. Hirt 1978 21 p refs Presented at the Numerical Methods for Partial Differential Equations Seminar, Madison, Wis., 23 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2813; CONF-7810149-1) Avail: NTIS HC A02/MF A01

A simplified algorithm is described for the numerical solution of the Navier-Stokes equations. Because of its simple construction, the algorithm serves as a good introduction to numerical fluid dynamics as well as a basis for developing many kinds of new solution methods. To illustrate the flexibility of this algorithm, simple modifications are described for introducing internal obstacles, an accelerated steady-state solution method, a potential flow option, and a method of increasing numerical accuracy. DOE

N80-12043# European Space Agency, Paris (France).
SIMILARITY IN NOZZLE FLOWS WITH VIBRATIONAL NONEQUILIBRIUM
Nimai K. Mira and Martin Fiebig *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 168-184 refs (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12044# European Space Agency, Paris (France).
MIXING LENGTH MODEL FOR COMPRESSIBLE TURBULENT FLOWS IN ROUGH CHANNELS
Wilhelm A. Neuberger *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 185-217 refs Transl. into ENGLISH from 'Ein Mischungsweg modell fuer kompressible turbulente Stroemungen in rauhen Kanaelen', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

N80-12206 Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION OF NITROMETHANE-AL-NO2 MIXTURES
H. Moulard, C. Fauquignon, A. Lichtenberger, and J. M. Lombard *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 3-21 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation, and 19 Spacecraft Instrumentation*.

N80-12382 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL RECORDING USING HOLOGRAM ARRAYS: DEVELOPMENTS OF THE TRANSDUCERS FOR AN EXPERIMENTAL 100MBIT/S RECORDER
K. Hacking and J. L. Riley Sep. 1979 28 p refs
(BBC-RD-1979/16; PH-206) Copyright. Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

Special transducers for use with an experimental holographic recorder have been partly developed. They are hologram page-composer with 60 ports, a solid-state digital light-deflector and a photodetector array for intercepting 100 light-beams. The page-composer is based on an electro-optic ceramic material in the form of a large slice placed between two matched arrays of lenses. This device produces 50 collimated digit-beams each of which can be modulated independently by external electronic switches. The digital light-deflector comprises several stages of electro-optic crystals coupled with passive Wollaston prisms. A suitable photodetector array for operation at low light-levels was developed. The design consists of a bundle of 100 monofilament light-guides attached to silicon photodiodes and followed by low-noise amplifiers. F.O.S.

N80-12383*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OPTICAL GYROSCOPE SYSTEM Patent Application
Willis C. Goss (JPL) and Raymond Goldstein, inventors (to NASA) (JPL) Filed 22 Dec. 1978 35 p Sponsored by NASA
(NASA-Case-NPO-14258-1; US-Patent-Appl-SN-972252) Avail: NTIS HC A03/MF A01, CSCL 20F

An optical gyroscope is disclosed which has high accuracy at both slow and fast rotation rates. The gyroscope operates alternately in two modes, one mode utilizing an added 90 deg phase shift and the other employing no added phase shift, to provide high sensitivity for a wide range of rotation rates. A

novel beam splitter is used which first lets the beam pass through, and is later energized to cause the returned beam to be reflected. Linear polarization of the light beam is maintained by keeping all fiber portions in curvature. NASA

N80-12384*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY APPLICATIONS AND EVALUATION RESULTS. LIXISCOPE: PROCEEDINGS OF THE LIXISCOPE CONFERENCE
Jul. 1978 89 p refs Conf. held at Greenbelt, Md., 27-28 Jul. 1978
(NASA-CP-2112) Avail: NTIS HC A05/MF A01 CSCL 14E
The principle of the Lixiscope along with its potential uses in industry, clinical medicine, and astrophysics are presented. For individual titles, see N80-12385 through N80-12397.

N80-12385*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LIXISCOPE CONCEPT
Lo I. Yin *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 3-4 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
A portable X-ray imagery instrument which utilizes a converter phosphor or scintillator to convert the X-ray image into visible light image is described. The potential medical as well as industrial applications of the Lixiscope are presented. M.M.M.

N80-12386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUTURE PROGRESS IN THE DEVELOPMENT OF THE LIXISCOPE
Jacob I. Trombka *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 5-6 ref (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
Some of the potential of the lixiscope in astrophysics as well as in space medicine are reported. The positioning of the lixiscope as a sensitive detector placed at the focal plane of a focusing or collimating X-ray telescope, and studies of the inter-coastal spacing during weightlessness are described. M.M.M.

N80-12387*# Howard Univ., Washington, D. C.
THEORETICAL CALCULATIONS AND INSTRUMENT DEVELOPMENT AND TEST CHARACTERIZATION OF LOW INTENSITY X-RAY IMAGING DEVICES
George Ferguson, Marshall Lewis, Rajinderbir Harval, Javan Anderson, and Sandra Brown *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 7-10 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The characteristics of the Lixiscope when excited by X-rays produced by conventional electrically powered X-ray generators are explored to determine the optimum X-ray spectrum and mode of operation of the generator, which yields satisfactory Lixiscope images of medical and industrial specimens. M.M.M.

N80-12388*# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
X-RAY SOURCE CHARACTERISTICS AND DETECTION EFFICIENCIES OF PROTOTYPE LIXISCOPES
Stephen M. Seltzer *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 11-14 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The radioactive X-ray sources and scintillator screens used in prototype Lixiscope units are described. Some of those considerations necessary for the optimization of future Lixiscope designs are stressed as well as some semi-quantitative information on the present prototype devices. M.M.M.

N80-12389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME CONTEMPLATED IMPROVEMENTS TO THE PROTOTYPE LIXISCOPE
Lo I. Yin *In its* Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 15-18 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
Some contemplated improvements on the Lixiscope are described. These can be divided roughly into two categories: those which are well within existing technology, and thus can be implemented immediately; and those which are more at the state-of-the-art level, and which are directly related to applications in X-ray and gamma ray imaging in astronomy. M.M.M.

N80-12390*# Duke Univ., Durham, N. C. Dept. of Radiology.
A COMPARISON OF THE LIXISCOPE WITH OTHER X-RAY IMAGING SYSTEMS
Fearghus OFoghludha *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 19-27 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The imaging techniques relevant in the determination of the clinical potential of the Lixiscope are reviewed. M.M.M.

N80-12391*# Howard Univ., Washington, D. C. Dept. of Orthopedics and Radiology.
ORTHOPEDIC EVALUATION
Thomas Walden *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 31-35 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The clinical performance of the Lixiscope in orthopedics was compared with routine radiography. Portability and size were the major advantages of the Lixiscope. The main disadvantage at this point in time was the Lixiscope's inability to study large areas. R.E.S.

N80-12392*# National Inst. of Dental Research, Bethesda, Md.
DENTAL RESEARCH: PRELIMINARY OBSERVATIONS AND PROJECTIONS
Richard L. Webber *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 37-41 refs (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The potential applicability of the Lixiscope in dentistry was investigated. Conceptual limitations on basic design requirements common to the Lixiscope are discussed. R.E.S.

N80-12393*# National Institutes of Health, Bethesda, Md.
DOSIMETRIC CONSIDERATIONS IN DENTAL APPLICATIONS
John C. Goble *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 43-44 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The integration of the Lixiscope into dental procedures was studied and compared with conventional dental radiographic techniques. It was found that through the use of intraoral sealed sources in conjunction with microchannel plate technology, the Lixiscope gives increased diagnostic information with decreased radiation dosage. R.E.S.

N80-12394*# Connecticut Univ., Farmington. Health Center.
MAXILLO: FACIAL DIAGNOSIS
Allan B. Reiskin *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 45-49 (For primary document see NP0-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E
The application of the Lixiscope in dentistry was studied. Due to a problem in resolution, it is concluded that, at this present time, the Lixiscope can only be as a previewing device for conventional radiography. R.E.S.

N80-12395*# Connecticut Univ., Farmington. Health Center.
PEDIATRICS
Thomas J. Spackman *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 51-59 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The utilization of the Lixiscope in pediatrics was investigated. The types of images that can presently be obtained are discussed along with the problems encountered. Speculative applications for the Lixiscope are also presented. R.E.S.

N80-12396*# Pennsylvania Coll. of Podiatric Medicine, Philadelphia. Dept. of Radiology.

PODIATRY

Stephen Weissman In NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 61-64 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The use of the Lixiscope in podiatry was preliminarily evaluated. It is concluded that the possibilities for the Lixiscope's clinical use in podiatry seems endless. R.E.S.

N80-12397*# National Aeronautics and Space Administration, Washington, D. C.

AN OVERVIEW OF THE NASA TECHNOLOGY UTILIZATION PROGRAM

Louis Mogavero *In* NASA. Goddard Space Flight Center Preliminary Appl. and Evaluation Results. Lixiscope Jul. 1978 p 67-77 (For primary document see N80-12384 03-35)
Avail: NTIS HC A05/MF A01 CSCL 14E

The NASA technology utilization program is described. The transfer of that technology is described along with the publications which distribute the technological information. R.E.S.

N80-12398*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EXPERIMENTAL STUDY OF LOW-ENERGY CHARGE TRANSFER IN NITROGEN

Alphonsa Smith Nov. 1979 33 p refs
(NASA-TM-80156; L-13248) Avail: NTIS HC A03/MF A01 CSCL 20L

Total charge transfer cross sections were obtained for the N2(+)-N2 system with relative translational ion energies between 9 and 441 eV. Data were obtained to examine the dependence of total cross section on ion energy. The effect of ion excitation on the cross sections was studied by varying the electron ionization energy in the mass spectrometer ion source over an electron energy range between 14.5 and 32.1 eV. The dependence of total cross section on the neutralization chamber gas pressure was examined by obtaining data at pressure values from 9.9 to 0.000199 torr. Cross section values obtained were compared with experimental and theoretical results of other investigations. R.C.L.

N80-12399*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

DETERMINATION OF NOISE EQUIVALENT REFLECTANCE FOR A MULTISPECTRAL SCANNER: A SCANNER SENSITIVITY STUDY

Daniel E. Gibbons (Fort Lewis Coll., Durango, Colo.) and Richard R. Richard Dec. 1979 31 p refs
(NASA-TP-1575; S-487) Avail: NTIS HC A03/MF A01 CSCL 14E

The methods used to calculate the sensitivity parameter noise equivalent reflectance of a remote-sensing scanner are explored, and the results are compared with values measured over calibrated test sites. Data were acquired on four occasions covering a span of 4 years and providing various atmospheric conditions. One of the calculated values was based on assumed atmospheric conditions, whereas two others were based on atmospheric models. Results indicate that the assumed atmospheric conditions provide useful answers adequate for many purposes. A nomograph was developed to indicate sensitivity variations due to geographic location, time of day, and season. R.C.T.

N80-12400# Sandia Labs., Albuquerque, N. Mex.

LASER VELOCIMETER MEASUREMENTS IN A CONSTANT VOLUME INTERNAL COMBUSTION ENGINE SIMULATOR

T. M. Dyer and P. O. Witze Aug. 1978 9 p refs Presented at 3d Workshop on Laser Velocimetry, West Lafayette, Ind., 11 Jul. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8721; Conf-780733-3) Avail: NTIS HC A02/MF A01

The transient gas motion in a constant volume combustor was studied with a dual beam backscatter laser anemometer system, using a counter-type signal processor. A highly-swirling methane-air mixture was introduced into an initially evacuated chamber through a tangentially-directed valve in the side of the cylinder. Time-resolved tangential component mean velocity measurements were made in both the pre- and post-combustion gases. High speed shadowgraph movies were also made to illustrate both the fluid motion and the combustion process. R.E.S.

N80-12401# SRI International Corp., Menlo Park, Calif.

AUTORADIOGRAPHIC ENHANCEMENT OF POLAROID FILM Final Report, 18 Apr. - 17 Oct. 1978

R. G. Manning and R. R. Pettijohn Nov. 1978 19 p Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48; SRI Proj. PYD-7420)
(UCRL-13952) Avail: NTIS HC A02/MF A01

The application of radiotracer photographic image enhancement techniques to increase the photographic speed of three Polaroid Films is presented. A state-of-the-art capability in the field of nondestructive photographic image enhancement of original negatives was acquired. These procedures have successfully increased optical density, contrast, and resolution of photographic imagery, and thereby increased the information derivable from original negatives. DOE

N80-12402# Wien Univ. (Austria). Inst. for Experimental Physics.

AEROSOL MEASUREMENTS IN THE SUBMICRON SIZE RANGE. STUDIES WITH AN AEROSOL CENTRIFUGE, A NEW DIFFUSION BATTERY, A LOW PRESSURE IMPACTOR AND AN ADVANCED CONDENSATION NUCLEI COUNTER Final Report, 1973 - 1978

Othmar Preining and Axel Berner May 1979 109 p refs
(Grant EPA-R-801983)
(PB-298073/8; EPA-600/2-79-105) Avail: NTIS
HC A06/MF A01 CSCL 14B

The investigations of four aerosol classifiers which cover finite, but overlapping ranges of the aerosol particle size spectrum are summarized. A cylindrical aerosol centrifuge, which measures aerodynamic equivalent diameters precisely was used as a reference instrument in diffusion battery experiments. The diffusion battery was investigated for fairly large particle sizes to determine the influence of sedimentation, interception, and impaction on the transmission of the diffusion battery. A five stage low pressure impactor which covers the size range from 0.1 micrometer to 25 micrometers diameter was developed specifically for the determination of the deposited particulate mass. A special condensation nuclei counter which measures number-size distributions in the size range from 0.002 micrometers to 0.1 micrometers KELVIN equivalent diameter was also developed. GRA

N80-12209 Institut Franco-Allemand de Recherches, St. Louis (France).

THE USE OF HOLOGRAPHY FOR KINETIC ENERGY MEASUREMENTS OF TARGET SPLINTERS

H. Royer and M. Giraud *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 110-121 refs (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12210 Institut Franco-Allemand de Recherches, St. Louis (France).

THE DEVELOPMENT OF PASSIVE DOPPLER TECHNIQUES IN LRSL/ISL AND THEIR APPLICATIONS TO BALLISTIC AND AERODYNAMIC MEASUREMENTS

B. Koch *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 122-166 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-12403 State Univ. of New York at Binghamton.

INTRACAVITY QUENCHING AND DYE KINETICS OF A

NITROGEN LASER PUMPED DYE LASER Ph.D. Thesis
William Gerard Divens 1979 125 p
Avail: Univ. Microfilms Order No. 7924328

The design and construction of a compact N2 laser pumped dye laser operating in the intracavity quenched mode is described. *The N2 laser spectrum as a function of pressure is presented* along with a double pulsing effect observed when the laser dye solution is probed with a HeNe laser. By removing the cavity *mirrors a double pulsing of the output beam was observed.* The double pulse phenomenon was studied with a number of different laser dyes. The results indicate that the effect is a *result of instantaneous changes in index of refraction caused by trans-*verse optical pumping of the dye molecules which are, subsequently, depopulated along one axis by the dye laser pulse.
Dissert. Abstr.

N80-12404 Columbia Univ., New York.
COLLISION AND PHOTOFRAGMENTATION DYNAMICS OF IR LASER PUMPED METHYL FLUORIDE AND CARBONYL FLUORIDE Ph.D. Thesis
Rekha Sapre Sheorey 1979 188 p
Avail: Univ. Microfilms Order No. 7924982

By placing excess vibrational population in the v sub 3 C-F *stretching mode of methyl fluoride by a Q-switched CO2 laser,* the time dependence of fluorescence signals from the overtone level 2v sub 3 and from all fundamental vibrational levels was *monitored. Laser induced fluorescence was studied in the infrared* region of the electromagnetic spectrum in order to yield information about the qualitative and quantitative aspects of vibrational energy transfer in polyatomic molecules. Energy transfer mechanisms and timescales on which the equilibration processes *occur were determined. Specific mode to mode energy transfer* rate constants were determined by analyzing the temporal behavior of the various excited vibrational state fluorescences.
Dissert. Abstr.

N80-12405*# National Aeronautics and Space Administration. *Goddard Space Flight Center, Greenbelt, Md.*
CHARACTERIZATION OF THE Q-SWITCHED MOBLAS LASER TRANSMITTER AND ITS RANGING PERFORMANCE RELATIVE TO A PTM Q-SWITCHED SYSTEM
John J. Degnan and Thomas W. Zagwodski Oct. 1979 76 p *refs*
(NASA-TM-80336) Avail: NTIS HC A05/MF A01 CSCL 20E

A prototype Q-switched Nd:YAG laser transmitter intended for use in the NASA mobile laser ranging system was subjected to various tests of temporal pulse shape and stability, output *energy and stability, beam divergence, and range bias errors.* Peak to peak variations in the mean range were as large as 30 cm and drift rates of system bias with time as large as 6 mm per minute of operation were observed. The incorporation of a fast electro-optic cavity dump into the oscillator gave *significantly improved results. Reevaluation of the ranging* performance after modification showed a reduction in the peak to peak variation in the mean range to the 2 or 3 cm level and *a drift rate of system time biases of less than 1 mm per minute* of operation. A qualitative physical explanation for the superior performance of cavity dumped lasers is given. K.L.

N80-12406# Naval Ocean Systems Center, San Diego, Calif.
NAVAL BLUE-GREEN SINGLE-PULSE DOWNLINK PROPAGATION MODEL Final Report, Jan. - Dec. 1978
P. J. Titterton (GTE-Sylvania), H. E. Sweeney (GTE-Sylvania), R. D. Anderson, R. F. Howarth, and M. E. Hyde 1 Jan. 1979 91 p refs
(AD-A071780; NOSC/TR-387) Avail: NTIS HC A05/MF A01 CSCL 17/2

This technical report describes the official Navy model for signal and noise characteristics of a single blue-green optical pulse propagated from a satellite laser source to a submerged receiver in all weather conditions. A mathematical model is developed in two groups: the signal group relates the instantaneous received optical signal power, while, the noise group relates the total noise equivalent optical power to the noise source. Both groups of the model account for propagation path and receiver characteristics; and, they allow calculation of the signal-to-noise ratio for any blue-green single-pulse downlink *from a satellite laser source to a submerged receiver. The* relative technical uncertainty in accuracy of both equation groups has also been included. GRA

N80-12407# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
MINICOMPUTER APPLICATIONS IN AUTOMATED TESTING OF ELECTRO-OPTICAL GUIDANCE SYSTEMS
Ray E. Schneider 19 Mar. 1979 23 p
(AD-A073092; DRDMI-T-79-38) Avail: NTIS HC A02/MF A01 CSCL 17/8

An Automated Laser Seeker Performance Evaluation System (ALSPES) has been developed which utilizes a minicomputer to implement the control functions required to test electro-optical *(E/O) guidance systems. These tests are used by the Government* to identify problem areas in the guidance system design and to validate subsequent design changes. Software programs have *been written for a series of tests which fully evaluate E/O seeker* performance. Test conditions are fed into a CRT terminal and the minicomputer conducts a fully automated, hands-off test by *varying such parameters as laser energy, target position and* velocity, seeker position and angular rate, and time separation between targets. This report discusses the types of automated *tests performed, the electro-optical test equipment utilized and* the layout of the test facility, the minicomputer to test equipment interface, and the cost savings resulting from the development of this automated test facility. GRA

N80-12408# *Lincoln Lab., Mass. Inst. of Tech., Lexington.*
RESEARCH STUDIES ON NEODYMIUM PENTAPHOSPHATE MINIATURE LASERS Final Report, 1 Oct. 1977 - 30 Sep. 1978
Stephen R. Chinn 30 Sep. 1978 59 p refs
(Contract F19628-78-C-0002)
(AD-A073140; ESD-TR-78-392) Avail: NTIS HC A04/MF A01 CSCL 20/5

The thermal conductivity and specific heat of NdP5O14 have *been measured using a dynamic electrical heating technique.* The values of the thermal conductivity tensor elements (in W/cm K) are Lambda sub a = .021, Lambda sub b = .00966, and Lambda sub c = .014. The specific heat is 0.141 cal/g-K, in excellent agreement with the value of 0.139 cal/g-K that *was measured by differential scanning calorimetry. We have* calculated the time-dependent heating effects of typical flash-lamp-excited round and rectangular laser rods. With repetition *rates limited to approx. 10 ppm, simple conductive cooling by* an ambient-temperature heat-sink should be adequate. Computer simulation of the flash-lamp-excited NPP laser has been carried *out by numerical solution of the laser rate equations. With 1 J* electrical input, typical calculated output energies are 24 mJ for normal-mode operation and 10 mJ for passively Q-switched operation. Optimum Q-switch absorption and output mirror transmission have also been calculated. Experimental studies of *such lasers have been made with varying laser rod size and* laser resonator parameters. GRA

N80-12409# ILC Technology, Inc., Sunnyvale, Calif.
LASER PUMP LAMPS Final Report, Feb. 1976 - Sep. 1978
Norman C. Anderson Wright-Patterson AFB, Ohio AFAL Feb. 1979 149 p refs
(Contract F33615-76-C-1029; AF Proj. 2028)
(AD-A072704; R-ILC-77-4/F; AFAL-TR-79-1002) Avail: NTIS HC A07/MF A01 CSCL 20/6

The subject program was undertaken to develop technology for producing a potassium vapor arc lamp with a 3000 hour lifetime. The lamp is to be used as optical pump source in a Nd:YAG laser transmitter as part of a space communications system. The lamp lifetime goal was successfully achieved, a characteristic lifetime of approximately 6000 hours being demonstrated for lamps built late in the program. In addition, the final lamp satisfied virtually all other design and performance requirements. Most of the effort on the program was directed at developing supporting technology for the lamp. This work included solving problems of basal plane cracking and potassium vapor attack of the sapphire envelope, developing a long-lived

cathode, determining the most efficient lamp fill, developing an oxidation protection coating for the Kovar endcaps, optimizing the Kovar-to-sapphire brazed seal design, conducting thermal design proof tests (including simulation of zero-g effects), improving the potassium filling procedure, developing an optimized lamp operating procedure, and conducting vibration tests. GRA

N80-12410# Naval Research Lab., Washington, D. C
HEATED ELECTRON BEAM CELL STUDY Final Report, Jun. 1977 - May 1978
J. G. Eden and S. K. Searles 12 Mar. 1979 12 p
(AD-A072875; AD-E000310; NRL-MR-3957) Avail: NTIS HC A02/MF A01 CSCL 20/5

In general, high power gas lasers operate with simple laser species at room temperature. High power electronic state gas lasers, however, operate only with diatomic rare gas or rare gas halide laser molecules. To increase the number of laser molecules for high power laser operation, it is necessary to raise cell temperature above room temperature. The alkali metals, Group I, become volatile, at 400-500 C. At even higher temperatures the metals in Groups IIB, IIIA, IVA, and VA have significant vapor pressures. The purpose of this work is to advance the state of the art of high temperature cell design to allow laser discovery experiments to proceed with fewer technical difficulties. The design and operation of a new valve and a new cell for high temperature, high pressure operation is reported. GRA

N80-12411# AeroChem Research Labs., Inc., Princeton, N. J.
KINETIC SPECTROSCOPY OF METAL ATOM/OXIDIZER CHEMILUMINESCENT REACTIONS FOR LASER APPLICATIONS Final Report, 1 May 1976 - 30 Apr. 1979
Arthur Fontijn Jul. 1979 13 p refs
(Contract F44620-76-C-0108; AF Proj. 2303)
(AD-A073082; AEROCHEM-TP-388; AFOSR-79-0941TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

This work addressed the need to discover, characterize, and understand highly efficient metal atom/oxidizer chemiluminescent reactions for their potential as chemical electronic transition laser (CETL) pumps. Efforts concentrated on the reactions of the Group IVA elements Sn and Ge with N2O. Overall rate coefficients, photon yields, and quenching coefficients were measured and mechanistic insights were obtained. Techniques for such studies were further developed and critically compared to those in use elsewhere. The experiments were performed in high-temperature fast-flow reactors (HTFFR) which allow for independent control of temperature, total pressure, and reactant and quencher concentrations and are thus uniquely suited to kinetic measurements. The detailed results are contained in a number of publications, the abstracts of which are included. It is concluded that Sn/N2O is the most attractive CETL candidate of the Group IVA element/N2O reactions but that, as a practical device, it may face development difficulties due to product quenching. GRA

N80-12213 Institut Franco-Allemand de Recherches, St. Louis (France).
TRANSIENT INTERACTIONS OF LASER PULSES WITH MATTER
K. Danse *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 227-241 refs In GERMAN; ENGLISH summary
(For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

N80-12214 Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDIES OF LASER INDUCED DETONATION WAVES
M. Hugenschmidt and K. Vollrath *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 242-259 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-12412 Syracuse Univ., N. Y.
OIL WHIRL AND CRITICAL INSTABILITIES IN ROTOR-BEARING SYSTEMS Ph.D. Thesis
Ehtisham Uddin Ahmad Siddiqui 1979 272 p
Avail: Univ. Microfilms Order No. 7925653

The phenomenon of oil whirl is analyzed and the critical instabilities of a rotor system with flexible supports are determined. It is found that: (1) instability is not eliminated even for the case of infinitely rigid shafts; (2) a proper choice of foundation parameters raises the whirl threshold significantly above that obtained with rigid supports; and (3) external damping has a stabilizing effect on the rotor system, but the effect of external dampers on the critical speeds depends on the position of attachment to the rotor. A general formulation to determine critical speeds of an N mass system in journal bearings is given. To illustrate the feasibility of the program developed, damped natural frequencies are determined using a nine station model of a turbocompressor. Dissert. Abstr.

N80-12413 Kansas Univ., Kansas City.
ASSIST OF AN AIR-TO-AIR HEAT PUMP USING SOLAR HEATED HOT WATER Ph.D. Thesis
Margaret Sanders Drake 1979 110 p
Avail: Univ. Microfilms Order No. 7925871

An air-to-air heat pump of the type usually installed in residences was investigated. A split unitary heat pump was used with duct and outlets installed to approximate an actual installation. A 55 gallon drum fitted with an electric immersion heater simulated a solar heated water storage tank. Circuit piping led from the storage tank to a hot water coil located ahead of the outdoor refrigerant coil. The results indicate that a hot water solar system could be incorporated with an air-to-air heat pump and improve the utility of both systems. Solar-heated hot water was used down to a temperature of 60 F which was well below the necessary temperature for direct space heating. The Coefficient of Performance of the heat pump improved an average of about 50 percent and ranged from about 2.0 at 15 F ambient to 3.0 at 45 F ambient with solar assist. The heat output of the heat pump at a given outdoor temperature increased with solar assist from about 40 percent at an outdoor temperature of 15 F to about 25 percent at an outdoor temperature of 45 F. Dissert. Abstr.

N80-12414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFIED FACE SEAL FOR POSITIVE FILM STIFFNESS Patent Application
Izhak Etsion (Technion-Israel Inst. of Technol., Haifa) and Abraham Lipshitz, inventors (to NASA) (Technion-Israel Inst. of Technol., Haifa) Filed 7 Nov. 1979 7 p Sponsored by NASA
(NASA-Case-LEW-12989-1; US-Patent-Appl-SN-092145) Avail: NTIS HC A02/MF A01 CSCL 11A

An invention to improve the film stiffness of a face seal without increasing the sealing and dam area is described. The improved sealing apparatus has a primary seal ring in the form of a nose piece. A spring forces a sealing surface on the seal ring into sealing contact with a seat to form a face seal. A circumferential clearance seal is formed in series with this face by a lip on the nose piece. The width of the surface of the lip is substantially the same as the width of the sealing surface on the face seal. Also, the clearance between the surface on the lip and the shaft is substantially the same as the spacing between the face sealing surfaces on the face seal when the shaft is rotating. The circumferential clearance seal restricts the flow of fluid from a main cavity to an intermediate cavity with a resulting pressure drop. The hydrostatic opening is strongly dependent on the face seal clearance, and the desired axial stiffness is achieved. NASA

N80-12415# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
ABRASIVE MACHINING OF MAJOR COMPONENTS

John Rodd May 1979 70 p refs
(AD-A071916; ARLCB-MR-79010) Avail: NTIS HC A04/MF A01 CSCL 13/8

The term 'abrasive machining' has been expressed in many ways. It is generally used to denote stock removal operations that are more economically performed by abrasive grinding methods than the more conventional means of turning or milling. The two largest fields for abrasive machining are the production of flat surfaces and form grinding from the solid. This report is concerned with the latter; grinding various complex external shapes from the solid forging, bar stock or hollow cylindrical items. GRA

N80-12416# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
IMPROVED CAPABILITIES TO DETECT INCIPIENT BEARING FAILURES Interim Report, 1 May 1978 - 28 Feb. 1979
J. A. Alcorta and L. L. Packer Jun. 1979 67 p refs
(Contract F33615-78-C-2008; AF Proj. 3048)
(AD-A073123; FR-11509; AFAPL-TR-79-2050) Avail: NTIS HC A04/MF A01 CSCL 21/5

A methodology using a low level radiation technique for the detection of wear in gas turbine engine mainshaft bearings has been developed. In conjunction with SOAP analyses, the radioactive tag will detect low levels of wear and will simultaneously indicate whether the tagged bearing is the source of the wear. Iron-55 is employed as the active tag owing to its low radiation levels, long half-life, and homogeneity of the isotope in the bearing rollers. The low levels of radiation existent in the tagged wear particles requires the separation of wear debris from the oil. Membrane filtration of the oil for debris removal is undertaken due to its high recovery efficiency, simplicity of use, and adaptability for direct incorporation into the nuclear counting system. A gas flow proportional counter with cosmic guard detector and background shielding constitutes the most suitable low-level radio-activity measuring device for the iron-55 X-ray counting. The radioactive bearing tagging technique complements engine modularization by defining a diagnostic system that will identify specific engine bearings experiencing wear. By assessing the location of the distressed bearing, the tagging technique permits the confinement of engine teardown to the module in which the bearing is located. Author (GRA)

N80-12417# Oak Ridge National Lab., Tenn.
AUSTENITIC STAINLESS STEEL-TO-FERRITIC STEEL TRANSITION JOINT WELDING FOR ELEVATED TEMPERATURE SERVICE
J. F. King, G. M. Goodwin, and G. M. Slaughter 1978 9 p refs Presented to SAMPE Conf., Kiamesha Lake, N. Y., 17 Oct. 1978
(Contract W-7405-eng-26)
(CONF-781068-1) Avail: NTIS HC A02/MF A01

Failure mechanisms of ferritic to austenitic steel transition joints were investigated in an effort to improve service life. Failures of these joints are attributed to metallurgical changes in the HAZ of the welds and creep fatigue damage resulting from the mis-match of thermal expansion properties of the materials and the cyclic temperature service. It is shown by finite element analysis techniques that a 38% decrease in stress is possible at the critical ferritic steel-weld metal interface by using a material with an intermediate coefficient of thermal expansion between the ferritic steel and austenitic stainless steel and the use of small angle weld joint geometries. J.M.S.

N80-12418# Los Alamos Nuclear Corp., N. Mex.
TOWARD A COMPREHENSIVE MODEL FOR COMBUSTION IN A DIRECT INJECTION STRATIFIED CHARGE ENGINE
T. D. Butler, L. D. Cloutman, J. K. Dukowicz, J. D. Ramshaw, and R. B. Krieger (GM Res. Labs., Warren, Mich.) 1978 53 p refs Presented at Intern. Symp. on Combustion Modeling in Reciprocating Engines, Warren, Mich., 6 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3223; Conf-7811102-1) Avail: NTIS HC A04/MF A01

Computational models that simulate the single-cylinder dynamics of an engine cycle are presented. One engine concept discussed in detail is the direct injection stratified charge engine. The reactive fluid dynamics method is described and extended to include species transport and chemistry. Limitations of the models as they stand today are discussed as well as the prospects for their improvement. Illustrative calculations of a comparison between homogeneous and stratified operation in an axisymmetric cylinder with a cupped piston are described. R.E.S.

N80-12419# Sandia Labs., Albuquerque, N. Mex.
FRACTURE TOUGHNESS OF STEEL-ALUMINUM DEFORMATION WELDS
C. E. Albright Nov. 1978 162 p refs
(Contract EX-76-C-04-0789)
(SAND-78-1736) Avail: NTIS HC A08/MF A01

A study of the fracture toughness (in this case, G/sub Ic/) of steel-aluminum deformation welds using a specially developed double cantilever beam fracture toughness specimen is presented. Welds made at 350 C were heat treated at 380, 380, 400, 420, and 440 C. An intermetallic reaction product layer of Fe2Al5 was formed at the steel-aluminum interface with increasing heat treating temperature and time by a process of nucleation and growth of discrete particles. A transition in toughness from a higher average G/sub Ic/ value (6097 N/m) to a very low average G/sub Ic/ value (525 N/m) was observed. The decrease in toughness was accompanied by an increase in Fe2Al5 particle diameter from 4 to 8 micrometers. Failure at the higher toughness values is characterized by ductile rupture through the aluminum. At the lower toughness values, failure occurs between the aluminum and the Fe2Al5 reaction product layer. DOE

N80-12420# Idaho National Engineering Lab., Idaho Falls.
LONG-TERM BEARING WEAR TESTS OF CONVENTIONAL JOURNAL BEARINGS AND DEVELOPMENT OF HYDROSTATIC BEARINGS FOR THE LOFT DRAG-DISC TURBINE TRANSDUCER
J. R. Fincke 22 Mar. 1979 62 p refs
(Contract EY-76-C-07-1570)
(LTR-141-101) Avail: NTIS HC A04/MF A01

The details of a program concerning materials for use as turbine bearings in a pressurized water reactor environment are reported. Two types of bearings were examined, both conventional journal bearings and hydrostatic bearings. The results of long-term bearing wear tests conducted at 590 K and 15.1 MPa in water are presented. The feasibility of using hydrostatic bearings for the same transducer is demonstrated. DOE

N80-12421# National Highway Traffic Safety Administration, Washington, D. C. Technical Services Div.
AUTOMOBILE FUEL TANKS
Lois Flynn May 1979 102 p
(PB-298933/3; DOT-HS-804728; SB-33) Avail: NTIS HC A06/MF A01 CSCL 13F

Literature acquired since the establishment of the National Highway Traffic Safety Administration (NHTSA) is presented. It concerns automobile fuel tanks and fuel tank systems. NHTSA contract reports, reports of other organizations concerned with highway safety, and articles from periodicals in related fields are reported. GRA

N80-12208 Institut Franco-Allemand de Recherches, St. Louis (France).
MISCELLANEA CONCERNING TERMINAL BALLISTICS
G. Weihrauch, H. F. Lehr, and E. Wollmann *In its* Contrib. to Ballistics, Detonations, and Pulse Phys., 1979 p 36-110 refs In GERMAN; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-12422# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Systems

Dev. Mfg. Tech. Directorate.
ELECTRICAL OVERSTRESS PROGRAM
D. Mathews, P. P. Budenstein (Auburn Univ.), W. H. Causey, Jr. (BDM Corp.), L. G. Green, C. R. Jenkins, G. W. Neudeck (Purdue Univ.), D. H. Phillips (Rockwell Intern.), and W. D. Raburn (Alabama Univ.) 1 Sep. 1979 166 p refs
(AD-A073148; DRDMI-EA-78-22) Avail: NTIS HC A08/MF A01 CSCL 14/2

This report is a description of initial work on a program to provide information needed in the development of a nondestructive screen to eliminate junction bipolar devices especially susceptible to damage after second breakdown. Based on the results of the first 8 months of work, the decision has been made that the major thrust of the program should be towards identifying the reasons why specific samples of a given device type are unusually susceptible, rather than determining nominal susceptibility of generic types. GRA

N80-12423# General Dynamics Corp. Fort Worth, Tex.
OPTIMIZATION OF COMPUTER AUTOMATED ULTRASONIC INSPECTION SYSTEM Final Report, Jun. 1976 - Oct. 1978
Bill G. W. Yee, J. C. Couchman, and F. H. Chang Feb. 1979 199 p refs Prepared in cooperation with Pattern Analysis and Recognition Corp.
(Contract F33615-76-C-5104; AF Proj. 7351)
(AD-A072677; AFML-TR-79-4016) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes the work conducted on a program to optimize the hardware and software of a computer automated ultrasonic inspection system which was developed under a previous Air Force Contract F33615-72-C-1828. The hardware modifications included improvements of the scan drive mechanism to increase inspection speed and development of improved ultrasonic circuitry to perform zone scanning inspections. Software developments included: (1) implementation of the zone scanning inspection method, (2) programs for signal processing to enhance random flaw detection, and (3) development of a Computer Aided Design Data Control (CADDC) method to interface the inspection system with data generated by Computer Aided Design (CAD) approach to component design. GRA

N80-12424# Sandia Labs., Albuquerque, N. Mex.
EXPERIMENTAL VERIFICATION OF A COMBINED ENVIRONMENT ACCELERATED AGING METHOD APPLIED TO ELECTRICAL CABLE MATERIAL
K. T. Gillen 1978 16 p refs Presented at USNRC Water Reactor Safety Research Meeting, Germantown, Md., 6 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1907A; Conf-781146-16) Avail: NTIS HC A02/MF A01

The results of a continuing program whose main goal is the development of reliable accelerated aging techniques are described. One result of these studies was the development of an approach or method potentially applicable to combined environment aging when synergism is important. A brief review of this suggested approach is given, followed by an extensive discussion of aging data on a neoprene cable jacketing material. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-12425 Rensselaer Polytechnic Inst., Troy, N. Y.
A THEORY OF THERMOVISCOPLASTICITY Ph.D. Thesis
Edward Paul Cernocky 1979 226 p
Avail: Univ. Microfilms Order No. 7922225

A theory of three-dimensional infinitesimal isotropic viscoplasticity and thermoviscoplasticity is proposed and investigated in several homogeneous deformations. The theory is developed in separate stages of isothermal three-dimensional, isothermal uniaxial, and nonisothermal three-dimensional behavior. In an additional separate stage of development, a general method is given to construct classes of functions with an arbitrary almost constant (linear) initial interval of behavior, followed by a nonprescribed interval of monotonic nonlinear behavior. This region of nonlinear behavior is succeeded by an unbounded region of almost constant (linear) behavior. These functions are indispensible tools for the numerical simulation of predictions of this theory. Total strain is used and the strain tensor is not decomposed into a sum of elastic and inelastic contributions. The transition from initially linear thermomechanical behavior to nonlinear inelastic behavior is smooth. The theory is represented by both a mechanical constitutive equation and a constitutive assumption for the heat equation; these equations are separately postulated but are coupled through their common linear dependence upon the stress rate and strain rate tensors and the time rate of change of absolute temperature, and through their common nonlinear dependence upon the stress and strain tensors and the absolute temperature. Dissert. Abstr.

N80-12426 Wisconsin Univ. - Madison.
THE DYNAMIC RESPONSE OF ELASTIC ISOTROPIC THIN CIRCULAR CYLINDRICAL SHELLS TO INTENSE HEAT Ph.D. Thesis
Hemendra Kumar Mitra-Roy 1979 128 p
Avail: Univ. Microfilms Order No. 7918158

The dynamic response to periodic thermal inputs and to suddenly applied thermal loadings was investigated. The shell has simply supported ends which are free to move in the axial direction. The general solutions for displacements and stresses were obtained for axisymmetric temperature distributions, and numerical results are presented. The strains are linear functions of displacements and displacement gradients. The mathematical formulation of the problem consists of three, fourth order, coupled, linear ordinary inhomogeneous differential equations with inhomogeneous time-dependent boundary conditions. The method of solution is based on the fact that a boundary-value problem consisting of a homogeneous or inhomogeneous differential equations with inhomogeneous boundary conditions can be transferred into a problem consisting of an inhomogeneous differential equation with homogeneous boundary conditions. The transformed problem is then solved by modal analysis. Dissert. Abstr.

N80-12427 Wisconsin Univ. - Madison.
STRESSES IN THE NEIGHBORHOOD OF LOADED HOLES IN WOOD WITH APPLICATION TO BOLTED JOINTS Ph.D. Thesis
Thomas Lee Wilkinson 1978 162 p
Avail: Univ. Microfilms Order No. 7918175

Stresses and strains around a pin-loaded hole in a finite wood plate and the effects of material properties, plate geometry, and ratio of pin-to-hole diameter upon the stresses are described. Numerical (finite element) and experimental (strain gages and moire) techniques were used to obtain solutions. An iterative process of handling the contact problem between the pin and plate was developed using finite elements. Both conventional and fringe multiplication techniques of moire analysis were used. Correlation of results obtained by the various techniques was excellent. Relatively small variations in pin-to-hole size were found to produce very significant changes in the stresses. Significant changes were found in the shape, as well as the magnitude, of the stress field below the pin for short end distances. Results suggest that optimum end distance should be eight times the hole radius. Plate width should be at least four times the hole radius for Sitka spruce plates. The presence of friction between the pin and plate was found to greatly influence the stresses. The nature of the problem considered resulted in moderate changes in material stiffnesses producing only minor modifications in stresses. Dissert. Abstr.

N80-12428 Rhode Island Univ., Kingston.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF PIPE RISER CLAMPS Ph.D. Thesis
Umesh Chandra 1979 219 p
Avail: Univ. Microfilms Order No. 7925614

Two different types of pipe riser clamps (called type A and

type B) used to support the vertical runs of pipes in nuclear and fossil power plants were stress analyzed. Experimental investigations revealed the presence of large amounts of normal and shear stresses in the vicinity of the bend in type A clamp. By the use of longitudinal stiffeners in type B clamp, normal stress along the bend was very much reduced and most of the region bounded by the two stiffeners carried rather uniform shear. Two kinds of errors were found with nodal stress output using numerically integrated finite elements (isoparametric elements) in the analysis of a clamp. Heuristic explanations for these errors are given. Mathematical formulation for the elasto-plastic, creep and dynamic analysis of the clamps is presented. Dissert. Abstr.

N80-12429 Columbia Univ., New York.
A CONTRIBUTION TO THE DESIGN AND ANALYSIS OF PRECAST PRESTRESSED SHELLS OF REVOLUTION UNDER SYMMETRIC AND UNSYMMETRIC LOADS Ph.D. Thesis
Giuseppe DeCampoli 1979 202 p
Avail: Univ. Microfilms Order No. 7924871

The stresses produced by prestressing and by symmetric and unsymmetric load conditions in suspended shells of revolution with various boundary constraints are investigated with a precise, systematic analysis which also considers the initial suspension cable structure. Design and construction criteria are formulated using the indications of the results of the investigation. Dissert. Abstr.

N80-12430 Columbia Univ., New York.
BUCKLING AND POST-BUCKLING BEHAVIOR OF ELASTO-PLASTIC STRUCTURES Ph.D. Thesis
Ka-Kin Chan 1979 105 p
Avail: Univ. Microfilms Order No. 7924862

An investigation of the problem of buckling and post-buckling behavior of elasto-plastic structures consisting of beam elements is presented. A general finite element formulation of the basic equations of large deflections of elasto-plastic structures was developed. The criteria of uniqueness and stability was formulated in terms of the tangent stiffness matrices of the system. A system of constitutive equations of beams in terms of the axial strain and curvatures and the axial force and bending moments was proposed as a device for improving the efficiency of the calculations. The analysis of the post-buckling behavior includes a static determination of the configurations of equilibrium as well as a dynamic simulation of the motion of the system in the range of unstable post-buckling modes. Dissert. Abstr.

N80-12431 California Univ., Los Angeles.
INELASTIC BEHAVIOR OF STEEL STRUCTURES SUBJECTED TO EARTHQUAKE-INDUCED GROUND MOTION Ph.D. Thesis
Alvar Mehis Kabe 1979 207 p
Avail: Univ. Microfilms Order No. 7921423

The large amplitude inelastic response of steel structures to earthquake type motions, was investigated experimentally. The response data from one of the structures was used to check the accuracy of the structural analysis computer program DRAIN-2D. It was concluded that in order for the analytical model to reproduce accurately the nonlinear response of the structure at both small and large amplitudes of vibration, the yield moment and strain hardening stiffness must be changed during the analysis. This indicates, that the force deformation relationship incorporated in the model needs to recognize that after the initial few large amplitude cycles, the yield stress of the steel increases. Dissert. Abstr.

N80-12432 Dayton Univ., Ohio.
A PENALTY FUNCTION APPROACH FOR THE NONLINEAR FINITE ELEMENT ANALYSIS OF THIN SHELLS Ph.D. Thesis
Robert Allen Brockman 1979 230 p
Avail: Univ. Microfilms Order No. 7925692

A penalty method for the nonlinear structural analysis of thin shells was developed, based upon an incremental form of the potential energy. Penalty terms were introduced into the incremental variational principle, which yielded behavioral constraints of discrete Kirchhoff type as part of the stationary conditions. Discretization of the incremental principle then lead to thin shell finite elements. Applications of the method are described, including static and transient nonlinear solutions. Capabilities of the penalty function approach for predicting very large displacements and rotations are demonstrated in the sample analyses. Application of the developed technique to structures of practical size is shown in the nonlinear analysis of an aircraft windshield canopy. Dissert. Abstr.

N80-12433 Wichita State Univ., Kans.
DEVELOPMENT OF THE SUBSTRUCTURAL ELEMENT METHOD FOR STRESS ANALYSIS Ph.D. Thesis
Viswanathan Padmanabhan 1979 127 p
Avail: Univ. Microfilms Order No. 7925426

Two-dimensional problems with stress singularities are solved by discretizing the problem into substructural elements. The general formulation of the displacement function of the substructural elements is presented for solving two-dimensional problems with stress singularities. This is achieved by writing an Airy stress function for the element and by satisfying certain boundary conditions of the element exactly. Two problems - the End Problem and the Partially Clamped Plate Problem - are solved using both the methods. The results are evaluated and compared. For the End Problem, the results are also compared with results from a photoelastic experiment. Dissert. Abstr.

N80-12434 Virginia Polytechnic Inst. and State Univ., Blacksburg.
POSTBUCKLING STUDIES OF CURVED LAMINATED COMPOSITE PANELS Ph.D. Thesis
Nandalka Jayanth Kudva 1979 97 p
Avail: Univ. Microfilms Order No. 7925374

A finite element postbuckling analysis of various curved, midplane symmetric, laminated composite panels was performed. The loading considered was axial compression along the curved edges. Donnell's strain-displacement relations, which take quadratic nonlinearities into account, were used. The material behavior considered was linear elastic. For the curved composite panels considered, a 45 degree fiber orientation for some of the plies was found to yield the highest buckling load as well as the largest drop in the equilibrium load level along the postbuckling path. Dissert. Abstr.

N80-12435# National Aerospace Lab., Tokyo (Japan).
THE METHOD OF WEIGHTED RESIDUALS IN THE TIME DOMAIN APPLIED TO NONLINEAR VIBRATIONS
Tetsuhiko Ueda and Yuji Matsuzaki Mar. 1979 8 p refs
(NAL-TR-564T) Avail: NTIS HC A02/MF A01

A method to solve nonlinear differential equations governing periodic motion is presented. The approximation is based on the method of weighted residuals. As an example problem, nonlinear vibrations of an infinitely long cylinder are examined, and their frequencies are calculated, using various types of assumed solutions and weighting functions. The numerical results show that the Galerkin type of finite element procedure gives a good approximation. Author

N80-12436# Aeronautical Research Labs., Melbourne (Australia).
A SPECIAL CRACK TIP ELEMENT FOR THREE-DIMENSIONAL CRACK PROBLEMS
R. Jones and R. J. Callinan Nov. 1978 21 p refs
(ARL-Struc-Note-374; AR-001-319) Avail: NTIS HC A02/MF A01

A finite element method for determining the stress intensity factors along the edge of a crack in an arbitrary three-dimensional body is presented. A spectral element is placed around the crack front and in each special element the stresses and displacements are derived using the asymptotic nature of the stress and displacement fields near a crack tip. The method is based on a technique for evaluating the stress intensity factors in cracked sheets, and coincides with this method in the case of a through crack in a thin sheet. As illustrative examples, the problems of a semicircular surface flaw and an internal penny shaped crack are considered. In each case the computed values of the stress intensity factors are in excellent agreement with known analytical results. M.M.M.

N80-12437# Indian Inst. of Tech., Bombay. Dept. of Civil Engineering.
THERMAL STRESSES IN NON-HOMOGENEOUS SHELLS OF REVOLUTION: THEORY AND ANALYSIS

Tarun Kant Aug. 1979 85 p refs
(IIT-B/CE-79-2) Avail: NTIS HC A05/MF A01

A general theory for small deformations of a thick shell made up of a layered system of different orthotropic materials having planes of symmetry coincident with the orthogonal reference frame and subjected to mechanical and arbitrary temperature distribution is presented. Quadratic variations in thickness coordinate for all the three displacement components were assumed. Generalized Hooke's law which includes the effects of transverse shear deformation, transverse normal stress and transverse normal strain were used. The general equations were particularized for axisymmetric shells, and cast into a set of coupled first order ordinary differential equations suitable for numerical integration on a digital computer. R.E.S.

N80-12438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY DESIGN PROCEDURE FOR INSULATED STRUCTURES SUBJECTED TO TRANSIENT HEATING
Howard M. Adelman Washington Dec. 1979 53 p refs
(NASA-TP-1534; L-13144) Avail: NTIS HC A04/MF A01 CSCL 20L

Minimum-mass designs were obtained for insulated structural panels loaded by a general set of inplane forces and a time dependent temperature. Temperature and stress histories in the structure are given by closed-form solutions, and optimization of the insulation and structural thicknesses is performed by nonlinear mathematical programming techniques. Design calculations are described to evaluate the structural efficiency of eight materials under combined heating and mechanical loads: graphite/polyimide, graphite/epoxy, boron/aluminum, titanium, aluminum, Rene 41, carbon/carbon, and Lockalloy. The effect on design mass of intensity and duration of heating were assessed. Results indicate that an optimum structure may have a temperature response well below the recommended allowable temperature for the material. R.C.T.

N80-12439# Sydney Univ. (Australia). Civil Engineering Labs.
THE EFFECT OF PRE-CRACKING ON COLUMN BEHAVIOUR
R. Q. Bridge Apr. 1979 26 p refs
(PB-298743/6; R-344) Avail: NTIS HC A03/MF A01 CSCL 13B

An experimental investigation into the behavior under load of steel reinforced concrete columns containing cracks prior to the application of the load is presented. The pre-cracking was produced both by restrained shrinkage and by the release of loads sustained for periods up to six years. Bending in both single and double curvature was examined using a range of end eccentricities. The results demonstrate that apart from reducing the stiffness of the columns, pre-cracking can reduce the ultimate load capacity below that for similar columns which are uncracked prior to loading. It is shown that the influence of pre-cracking is accounted for in terms of an additional eccentricity of loading. GRA

N80-12440*# Mitre Corp., Houston, Tex.
NASTRAN PROCESSING AT JOHNSON SPACE CENTER
F. M. Richards, Jr. Mar. 1979 57 p refs
(NASA Order T-5295F; Contract F19628-79-C-0001)
(NASA-CR-160382; MTR-4722) Avail: NTIS HC A04/MF A01 CSCL 20K

The processing behavior of NASTRAN, a general purpose system of computer software used for solving engineering analysis problems by means of the finite element displacement method, is discussed. The host system for the NASTRAN is the Univac 1110, and the primary function is performing static and dynamic structural analyses of the Space Shuttle. The processing implications of the NASTRAN structural analysis are addressed and the current NASTRAN situation on the Univac 1110 is examined. The current NASTRAN workload is described and the effect of workload growth due to increased structure size is estimated. A cost and performance analysis is presented. A.W.H.

N80-12441# Oakland Univ., Rochester, Mich. School of Engineering.
DEVELOPMENT AND APPLICATION OF METHODS OF EXPERIMENTAL MECHANICS Annual Report
A. J. Durelli, J. D. Hovanesian, and Y. Y. Hung Aug. 1979 4 p
(Contract N00014-76-C-0487)
(AD-A072836) Avail: NTIS HC A02/MF A01 CSCL 14/2

The general objective of the research program is to develop method in experimental mechanics, with particular emphasis on stress analysis. The following phases have been dealt with: (1) new methods in three-dimensional photoelasticity, (2) viscoelasticity, (3) strains in actual solid propellant for rockets, (4) shrinkage stresses, (5) transient thermal stresses, (6) gravitational stress, (7) composite materials, (8) dynamic holography and photoelasticity, (9) interference phenomena, (10) two- and three-dimensional finite strains and stresses, (11) cables, (12) evaluation of relative merits and limitations of different experimental stress analysis methods, (13) elastostatics of boxes subjected to pressure and concentrated loads, (14) optimization of shapes, (15) speckle methods, (16) photoelastic coatings. GRA

N80-12442# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
SMALL-SCALE YIELDING AT THE TIP OF A THROUGH-CRACK IN A SHELL Interim Report
J. D. Achenbach and T. Bubenik Jan. 1979 10 p refs
(Contract N00014-76-C-0063)
(AD-A072832; NU-SML-TR-79-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

Deformation theory is used to model plastic deformation at the tip of a through-crack in a thin shell. In the vicinity of the crack the shell is subjected to both stretching and bending, but stretching is assumed to dominate. Thus, the stresses are tensile, but with a non-uniform distribution through the thickness, which depends on the material properties as well as on the geometry. The non-linear near-tip fields (which are singular) have been analyzed asymptotically. Cracks in shallow shells and spherical shells have been investigated in some detail. It is shown that the angular variations are the same as for generalized plane-stress plate problems. Assuming small-scale yielding a path-independent integral, which is valid in a region close to the crack edge, is used to connect the nonlinear near-tip fields with the corresponding singular parts of the linear fields. It is shown that the nonlinear behavior significantly affects the through-the-thickness variations of the near-tip fields. The singular parts of the membrane stresses tend to become more uniform through the thickness of the shell with stronger strain hardening. GRA

N80-12443# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
NEAR-TIP PLASTIC DEFORMATIONS IN DYNAMIC FRACTURE MECHANICS Interim Report
J. D. Achenbach, P. Burgers, and V. Dunayevsky Jul. 1979 23 p refs
(Contract N00014-76-C-0063)
(AD-A072833; BU-SML-TR-79-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Under rapid loading conditions and/or for a rapidly propagating crack, the mass density of a material affects the fields of stress and deformation. For such dynamic fracture problems plastic deformation in the immediate vicinity of a crack tip is investigated in this paper. Both stationary and propagating crack tips are considered. For a stationary crack tip, deformation theory is employed for the first phase of the loading when the fields are increasing monotonically with time. The general character of the near-tip fields is analyzed both with respect to its variation with time and with polar angle. The non-linear near-tip fields are related to the linearly elastic far-field by means of a path-independent integral. In the second part of the paper we consider rapidly propagating cracks. We discuss the near-tip fields for various models of material behavior. In particular we briefly review some earlier work by Achenbach and Kanninen for a rapidly propagating Mode-III crack, in a material which displays strain hardening. In the last part of the paper we consider the fields near a rapidly propagating crack-tip in an elastic-perfectly plastic material for the case that inertial terms are of importance. The system of governing equations in the plastic region is presented and shown to be hyperbolic in nature. As a first approximation the steady-state case with respect to the moving

crack-tip is considered and an asymptotic analysis of the near-tip field is carried out. GRA

N80-12444# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
ON SOME NEW GENERAL AND COMPLEMENTARY ENERGY THEOREMS FOR THE RATE PROBLEMS IN FINITE STRAIN, CLASSICAL ELASTO-PLASTICITY Interim Report
Satya N. Atluri Dec. 1978 50 p refs
(Contract N00014-78-C-0635)
(AD-A072969; GIT-ESM-SNA-10; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

General Variational theorems, for the rate problem of classical elastoplasticity at finite strains, in both Updated Lagrangean and Total Lagrangean rate forms, and in terms of alternate measures of stress-rate and conjugate strain-rates, are critically studied from the point of view of their application. Attention is primarily focused on the derivation of consistent complementary energy rate principles, which could form the basis of consistent and rational assumed stress type finite element methods; and two such principles, in both UL and TL forms, are newly stated. Systematic procedures to exploit these new principles in the context of a finite element method are also discussed. Also, certain general modified variational theorems, to enable an accurate numerical treatment of near incompressible behavior at large plastic strains, are discussed. GRA

N80-12445# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY 23: A PIECEWISE LINEAR THEORY OF PLASTICITY FOR AN INITIALLY ISOTROPIC MATERIAL IN PLANE STRESS
Philip G. Hodge, Jr. Nov. 1978 22 p
(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A073008; AEM-H1-23) Avail: NTIS HC A02/MF A01 CSCL 20/11

A 20-faced polyhedron is chosen as a reasonable piecewise linear approximation to either the Mises or Tresca yield criterion. Strain hardening and motion of the faces during hardening are assumed to be linear functions. Subject to the above assumptions, to initial isotropy, and to some reasonable symmetry requirements it is shown that the most general possible theory contains 11 material constants. Some simple experiments with a thin-walled tube are suggested for determining these constants. GRA

N80-12446# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
RATE COMPLEMENTARY ENERGY PRINCIPLES FINITE STRAIN PLASTICITY PROBLEMS AND FINITE ELEMENTS Interim Report
Satya N. Atluri Jun. 1979 13 p refs Submitted for publication
(Contract N00014-78-C-0636)
(AD-A072970; GIT-ESM-SNA-14; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Complementary energy theorems, for the rate problem of finite strain classical elasto-plasticity, in both Updated and Total Lagrangean forms with alternate stress-rates and conjugate measures of strain rate, are studied from the point of view of their application in finite elements schemes. Two new complementary theorems, in Updated and Total Lagrangean forms respectively, are proposed. The relative merits of these in application to finite-strain elasto-plastic stress analysis, in the treatment of near-incompressibility at large plastic flow, and treatment of buckling problems, are briefly discussed. GRA

N80-12447# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
RECOMMENDED PLAN FOR PROJECT FRACT: A CRITICAL EVALUATION OF FRACTURE RELATED ANALYTICAL AND COMPUTATIONAL TECHNIQUES Progress Report, Jun. 1978 - Jun. 1979
J. L. Swedlow, S. E. Benzley (Sandia Labs. N.M.), W. E. Haisler (Texas A.&M. Univ.), A. S. Kobayashi (Washington Univ.), H. J. Konish (Westinghouse R&D), J. C. Newman (NASA, Langley), C. H. Parr (Lord Kinematics), J. S. Solecki, and W. K. Wilson (Westinghouse R&D) Jul. 1979 49 p refs
(Contract N00014-78-C-0528)
(AD-A072773) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report outlines a plan for critical evaluation of fracture related analytical and computational techniques. The plan involves ten to twelve investigators who, by various techniques, 'solve' a succession of problems involving elastic and elasto-plastic behavior, followed by residual fields after load removal. Solutions would proceed by analytical, computational and experimental techniques, applied to closely defined problems. The problems represent a sequence of stress concentrations, from none to mild to sharp - as used in fracture testing. The sequence of problems is intended to identify the essential needs for modeling of such problems to produce accurate results. The plan is described in terms of procedure and phasing over a two-year period, and the problems are described in terms of their experimental set-up. Thin-plate, round, and thick-section configurations are included. The report was prepared by a Planning Committee of experts in the field, and a preliminary draft was reviewed by a larger Advisory Group. Comments received during this review process are incorporated into this report. GRA

N80-12448# California Univ., Los Angeles. Dept. of Materials.
ACOUSTIC EMISSION METHOD FOR STRESS AND STRAIN DETERMINATION
M. Shibata and K. Ono Apr. 1979 11 p refs Presented at Inst. of Acoustics Conf., London, 3-5 Apr. 1979
(Contract N00014-75-C-0419)
(AD-A072774; TR-79-02) Avail: NTIS HC A02/MF A01 CSCL 20/1

Acoustic Emission (AE) was detected during magnetization of a nickel and was also found to depend on applied stress. Varying AE outputs were observed on several ferromagnetic materials under alternating magnetic field. This magnetomechanical AE phenomenon has a potential of performing nondestructive measurements of residual stresses in structures, components and weldments, and we examined systematically effects of applied stress and magnetic field strength in ferritic steels. Several carbon steels, A533B steel and Armco iron were tested in annealed or normalized condition. By employing two AE transducers (AC 175L and MAC 500), rms voltages were measured at two frequency ranges. Maximum stress level was 350 MPa. It was found that 1020 steel shows the highest AE response among the material tested. Residual stress levels can be determined by monitoring the outputs of two AE transducers for a given material condition. The amount of prior cold work can also be obtained by monitoring this AE phenomenon. Details of experimental findings will be discussed towards the goal of developing a new method of nondestructive evaluation of residual stress and material conditions. GRA

N80-12449# California Univ., Livermore. Lawrence Livermore Lab.
OASIS: A GENERAL PURPOSE MESH GENERATOR FOR FINITE ELEMENT CODES
M. A. Gerhard 26 Apr. 1979 89 p refs
(Contract W-7405-eng-48)
(M-101) Avail: NTIS HC A05/MF A01

A general purpose mesh generator for two and three dimensional finite element codes is described. The basic parts of OASIS are the surface generator and the three dimensional region generator, both of which use a linear blending interpolation formula. Integer space and geometric space coordinate systems are used. In 2D, OASIS generates triangular transitional elements, 4 node isoparametric elements, 5 to 9 node continuum elements, bars, and beams. In 3D, OASIS generates 8 node isoparametric elements as well as 9 to 27 node continuum elements and trusses. In 2D, a standard quad element may degenerate into a triangle. In 3D, a standard brick may degenerate into a triangular pyramid. Displacement, rotation, and traction boundary conditions may be applied in both 2D and 3D. DOE

N80-12450# California Univ., Richmond. Earthquake Engineering Research Center.
LINEAR AND NONLINEAR EARTHQUAKE RESPONSES OF SIMPLE TORSIONALLY COUPLED SYSTEMS
Christopher L. Kan and Anil K. Chopra Feb. 1979 120 p refs

(Grant NSF ENV-76-04264)
(PB-298262/7; UCB/EERC-79/03; NSF/RA-790122) Avail: NTIS HC A06/MF A01 CSCL 13M

The effects of torsional coupling on the earthquake response of simple one-story structures in both elastic and inelastic ranges of behavior are analyzed. The structures considered are symmetrical about one principal axis of resistance, resulting in coupling only between lateral displacement along the perpendicular principal axis and the torsional displacement. Torsional coupling arising only from eccentricity between centers of mass and elastic resistance is considered. Systems with several resisting elements, columns and walls are idealized by a single-element model. Response of such a model to a selected earthquake ground motion are presented for a wide range of the basic structural parameters. The results presented include maximum lateral and torsional deformations of the system as well as maximum deformation of individual columns. It is shown that the inelastic response is affected by torsional coupling to generally a lesser degree than elastic response. Procedures for estimating, to a useful degree of approximation, the maximum responses of elastic and inelastic systems from the corresponding response spectra and the maximum deformations of individual columns from the displacements at the center of mass are presented. GRA

N80-12451# California Univ., Richmond. Earthquake Engineering Research Center.
HYSTERETIC BEHAVIOR OF LIGHTWEIGHT REINFORCED CONCRETE BEAM-COLUMN SUBASSEMBLAGES
Brian Forzani, Egor P. Popov, and Vitelmo V. Bertero Apr. 1979 110 p refs
(Grant NSF ENV-76-04263)
(PB-298267/6; UCB/EERC-79/01; NSF/RA-790121) Avail: NTIS HC A06/MF A01 CSCL 13M

The behavior of interior beam-column joints of a ductile moment-resisting frame constructed of lightweight aggregate concrete is investigated. The effects of bond deterioration in the joint region are emphasized. Results of experiments carried out on two lightweight R/C specimens are compared with similar experiments on specimens constructed of normal weight concrete. The specimens perform similarly when subjected to monotonically increasing lateral loads, but lightweight specimens perform when subjected to cyclic loading similar to that which can be expected from severe seismic excitations. Recommendations are given for improving observed behavior and for further research. GRA

N80-12452# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
BOND STRESS-SLIP RELATIONSHIP AND CRACKING RESPONSE OF REINFORCED CONCRETE COMPOSITE ***Progress Report***
S. Somayaji and S. P. Shah Jun. 1979 71 p refs
(Grant NSF ENG-77-23534)
(PB-297744/5) Avail: NTIS HC A04/MF A01 CSCL 13C

An analytical model was developed based on an assumed bond stress distribution function rather than an assumed bond stress-slip function. The constants of the bond stress distribution function were obtained by integration of the function in steps and by satisfying the boundary conditions. Using this approach, equations were derived to predict the complete composite response, including crack width, stress-strain curve and the tension stiffening effect. The theoretical predictions of composite response were in good agreement with the experimental data on mortor specimens reinforced with the varying volume and diameter of longitudinal bars. GRA

N80-12453# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
FRACTURE BEHAVIOR AND ANALYSIS OF FIBER REINFORCED CONCRETE BEAMS ***Progress Report***
G. Velarco, K. Visalvanich, S. P. Shah, and A. E. Naaman Mar. 1979 129 p refs
(Grant NSF ENG-77-23534)
(PB-297743/7) Avail: NTIS HC A07/MF A01 CSCL 13C

Linear and elastic-plastic fracture mechanics approaches are summarized with a particular emphasis on their applications to fiber reinforced cementitious materials. Fiber reinforced concrete beams with varying notch depths and different volume fractions of fibers were tested. The results were analyzed to examine the applicability to fiber reinforced concrete of various experimental and analytical fracture mechanics approaches including: (1) critical stress intensity factor, (2) J integral, (3) critical crack opening displacement, (4) compliance techniques for determining slow crack growth, and (5) R curve analysis. Attempts were made to identify a fracture parameter which is independent of test specimen geometry and which can correctly predict the effects of fiber additions. GRA

N80-12028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION METHODS ASSOCIATED WITH THE LAWS OF CYCLIC AND DAMAGE BEHAVIOR
Serge Savalle and Jean-Pierre Culie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 71-92 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 263-278 Original language report was announced as A79-18535 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

N80-12029# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION OF STATIC THERMOELASTIC PROPERTIES OF MEDIA WITH PERIODIC STRUCTURES
Daniel Engrand *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1978-5 Jul. 1979 p 97-102 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestrial (Paris), no. 1978-5, Sep. - Oct. 1978 p 283-286 Original language report was announced as A79-18537 (For primary document see N80-12021 03-01)
Avail: NTIS HC A06/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

N80-12454 Oklahoma Univ., Norman.
THE EFFECTIVENESS OF TWO AND THREE DIMENSIONAL *ISARITHMIC SURFACES IN COMMUNICATING MAGNITUDE, GRADIENT, AND PATTERN INFORMATION* Ph.D. Thesis
Joseph William Frasca 1979 286 p
Avail: Univ. Microfilms Order No. 7923784

The influence of cartographic variables on communication efficiency from two dimensional maps and perspective diagrams was assessed by using a factorial analysis of variance. Communication efficiency was operationalized by an index score based on each map reader's accuracy and response time for perceptual tasks pertaining to height assessment, steepest slope identification, and assessment of surface trend. Results indicated that two dimensional isarithmic maps were more efficient in transferring height information to map readers. Perspective maps were more efficient in transfering steepest slope and trend information than two dimensional isarithmic maps. These results for all three information types were, however, conditioned by two and three-way combinations of the independent variables on efficiency. Dissert. Abstr.

N80-12455 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany). Abt. des Deutschen Geodaetischen Forschungsinstituts.
INFORMATION RELATIVE TO CARTOGRAPHY AND

GEODESY, SERIES 2: TRANSLATIONS
1978 178 p refs
(Rept-36) Copyright. Avail: Issuing Activity

Topics are presented on photogrammetry research. The subjects include auto and cross-correlation of image coordinates, geometrical analysis of LANDSAT imagery, depth information from underwater acoustical scanners, effect of aircraft attitude on image geometry of linear array sensors, on-line aerial triangulation, bundle adjustment with field and self calibration texture analysis by means of synthetic impulse functions. For individual titles, see N80-12456 through N80-12466.

N80-12456 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTO- AND CROSS-CORRELATION OF IMAGE COORDINATES
F. Ackermann and M. Schlilcher *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 5-24 (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Two series of wide-angle and of super wide-angle photographs of the testfield Rheidt are used to determine empirically the correlation of image coordinates within a photograph and between different photographs. The results show strong correlations which remain constant even between different photographs. The correlations depend on the systematic image errors which are reduced considerably to small magnitudes by their compensation. Author (ESA)

N80-12457 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
GEOMETRICAL ANALYSIS AND RECTIFICATION OF LANDSAT MSS IMAGERY: COMPARISON OF DIFFERENT METHODS
H.-P. Baehr *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 25-46 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The quality of four different mathematical models (Helmert-transformations, second-order polynomials, collinearity equations, prediction) is discussed with respect to geometrical analysis of LANDSAT imagery. This leads to operational digital rectification procedures, providing two levels of accuracy: a bulk approach, applying scale factors and earth rotation and needs no or little ground control and yields an accuracy of about 2 pixel units; and a precision approach taking second order polynomials and 9 ground control points yields at least 1 pixel. Author (ESA)

N80-12458 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A STUDY IN THE DETERMINATION OF DEPTH INFORMATION FROM UNDERWATER ACOUSTICAL SCANNERS
E. Clerici and G. Konecny *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 47-65 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A general mathematical model for the determination of depths using stereoscopic side scan sonar images is described. It is based on the assumption that the attitude and position parameters of the sensor can be continuously recorded or reconstructed by calculation. Three computer application programs were developed, operating in sequence to determine the Z coordinate of the intersection point of two range vectors from active sensors.
Author (ESA)

N80-12459 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EFFECT OF AIRCRAFT ATTITUDE CHANGES ON IMAGE GEOMETRY OF LINEAR ARRAY SENSORS
Egon Dorrer *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 67-77 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The kind of geometry to be expected in airborne line scanned imagery as a consequence of attitude changes of the sensor carrier is analyzed. The theoretical discussion of this problem is based upon a digital computer simulation of the sensor's kinematic behavior during flying conditions. Some speculative conclusions are drawn as to what intrinsic properties of the image geometry could be used to reconstruct the orientation of the sensor. The results show that considerable numerical efforts must be made to solve the given equations. The problem was programmed in APL language. Author (ESA)

N80-12460 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
HEIGHT INTERPOLATION BY THE METHOD OF FINITE ELEMENTS
Heinrich Ebner and Peter Reiss *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 79-94 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A method for the interpolation of the heights in a regular square grid is suggested, which is based on the Finite Element Method. The chosen formulation allows filtering of any desired amount as well as a direct and rigorous consideration of terrain inhomogeneity and discontinuities. Practical application examples are shown as perspective images of the interpolated digital height models, including the effect of various amounts of filtering.
Author (ESA)

N80-12461 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BUNDLE ADJUSTMENT WITH FIELD AND SELF CALIBRATION: RECENT RESULTS
Heiko Ellenbeck and Guenther Kupfer *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 95-111 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Application of field and self calibration of photogrammetric systems along with bundle adjustment procedure is demonstrated with two experiments. Both approaches lead to optimized results only if the calibration is made without alteration of any component of the photogrammetric system. Triangulation results for judging pros and cons of both approaches is given, showing comparable accuracy. Author (ESA)

N80-12462 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PROGRESS IN PHOTOGRAMMETRIC POINT DETERMINATION BY COMPENSATION OF SYSTEMATIC ERRORS AND DETECTION OF GROSS ERRORS
Armin Gruen *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 113-140 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

Some basic problems of gross error detection and systematic error compensation procedures are discussed. The compensation of systematic errors in bundle adjustment is analyzed with the conclusion that further investigations are necessary if a better insight into the correlation problems of additional parameters and ground point coordinates are to be obtained. The accuracy potential of self-calibrating bundle adjustment is discussed. Finally, the problem of gross error detection is considered, showing that in order to obtain a minimum of bundle interactions a first stage of gross error detection should be combined with the computation of the approximate values of bundle adjustment. Author (ESA)

N80-12463 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON-LINE AERIAL TRIANGULATION WITH THE PLANICOMP C-100 ANALYTICAL STEREOPLOTTING SYSTEM
Dierk Hobbie *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 140-150 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

The applications of the C-100 PLANICOMP analytical stereoplotting system are described. The system includes a basic opto-mechanical unit, a photogrammetric control panel, control unit, computer, computer terminal preferably in the form of a video screen, and optional peripheral equipment and plotting table. The measurement-technique of on-line aerial triangulation is explained and the improvement in speed and gross error detection by automatic prepositioning of points and immediate display of residuals after completion of measurement is discussed. Author (ESA)

N80-12484 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BLOCK-ADJUSTMENT PROGRAMS FOR MINICOMPUTERS
H. Klein *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 151-161 *(For primary document see* N80-12455 03-43)
Avail: Issuing Activity

The PAT-M and PAT-B computer programs for block adjustment with independent models and bundles, including additional parameters are reviewed. The viewpoints, problems *and results of adapting these programs to minicomputers are* explained and admissible block sizes given. A listing of comparable computing times and a special strip-adjustment program are *presented.* Author (ESA)

N80-12485 Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTOMATIC DATA ACQUISITION FOR DIGITAL HEIGHT MODEL
Gerald Lindig *In its* Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 163-168 refs (For primary document *see N80-12455 03-43)*
Avail: Issuing Activity

Experiments on automated height measurement using the *ITEK-Correlator EC-5 planimat D-2 system are discussed. Software* solutions were developed in order to solve the problems observed in the first attempts to use the EC-5 correlator for data acquisition *for the Digital Height Model. The solutions have in common the* necessity to measure additional planimetric lines such as edges of woods, built-up areas or break-lines. Some hardware and software improvements in the EC-5 itself were also adopted. A satisfactory accuracy of height measurements by using the modified system is expected. Author (ESA)

N80-12486 Institut fuer Angewandte Geodaesie, Frankfurt am *Main (West Germany).*
TEXTURE ANALYSIS BY MEANS OF SYNTHETIC IMPULSE FUNCTIONS
Bernd-Siegfried Schulz In its Inform. Relative to Cartography and Geodesy. Ser. 2: Transl. 1978 p 169-178 refs (For primary document see N80-12455 03-43)
Avail: Issuing Activity

A method for object recognition utilizing multispectral data, which is different from statistical procedures and harmonic analysis, is presented. An area structure is described by an impulse pattern and then impulse functions are generated and systematically varied with regard to the duration, gap and phase of the impulse until the optimum adaptation to the given data is achieved. A test run made on areas with uniform texture is described, and the resulting autocovariance function is presented. The extension of this procedure to the classification according to their texture is discussed. Author (ESA)

N80-12467 Technische Hochschule, Darmstadt (West Germany). Fachgebeit Fernerkundung und Photointerpretation.
ON MEASUREMENTS FROM AIRCRAFT Final Report
Joerg Albertz and Manfred Schroeder Jun. 1978 505 p refs In GERMAN; ENGLISH summary Presented at Symp. Airborne Sensing Programme, Hanover, 29-31 Aug. 1977 Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany (Contract BMFT-WE-0175)
(BMFT-FB-W-78-04) Avail: Issuing Activity

Some fifty papers are presented on the techniques developed and applied in the framework of the German remote sensing program pursued during the 1975 to 1977 period. Airborne multispectral imaging techniques were applied to the following disciplines: oceanography and coastal processes, urban and regional management, agriculture and forestry, geology and hydrology. Intensive research work in the fields of digital image processing and the spectral signatures of natural surfaces were associated with this program. For individual titles, see N80-12468 through N80-12517.

N80-12468 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AIMS AND TASKS OF THE AIRCRAFT TEST PROGRAM [ZIELE UND AUFGABEN DES FLUGZEUGMESSPROGRAMS]
Manfred Schroeder *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 11-22 refs In GERMAN (For primary document *see* N80-12467 03-43)
Avail: Issuing Activity

Studies were carried out for developing German remote *sensing equipment for future participation in international* satellite projects for global and regional environmental monitoring systems. Emphasis is given to work in the following fields: *multispectral imaging techniques, development of systems for* the digital treatment of images, applications to geoscience problems, evaluations for future technological developments, *balanced organizational and interdisciplinary teams.*Author (ESA)

N80-12469 Technische Universitaet, Hanover (West Germany).
ON THE CURRENT STATE OF REMOTE SENSING TECHNIQUES [ZUM GEGENWAERTIGEN STAND DER FERNERKUNDUNG]
G. Konecny *In* Tech. Hochschule On Meas. from Aircraft Jun. *1978 p 23-36 refs In GERMAN (For primary document see* N80-12467 03-43)
Avail: Issuing Activity

Several different aspects of current work are discussed: radiation characteristics of various objects, choice of sensors, choice of platform, data processing (analog and digital), and the *handling and interpretation of complex information.* A specific problem which benefits from the exploitation of such techniques is then exposed: the Jade coast region. The economic importance of the region is underlined. It is concluded that a high resolution thermal sensor and an even higher resolution optical sensor are invaluable for coastal water and engineering studies.
Author (ESA)

N80-12470 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
FUTURE REMOTE SENSING PROGRAM OF THE DFVLR [DAS ZUKUENFTIGE FERNERKUNDUNGSPROGRAMM DER DFVLR]
H. Sax *In* Tech. Hochschule On Meas. from Aircraft Jun. *1978 p 37-50 refs* In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Work for evaluating German technology, and for defining the DFVLR European and international role is described. The most important elements of the DFVLR programs are: studies of various systems, basic research and the development of new methods, technological research and development and aiding equipment users. Attention is given to combined optical and microwave systems and their applications as satellite measurement devices. Data processing techniques are also discussed.
Author (ESA)

N80-12471 Freiburg Univ. (West Germany).
INTERNATIONAL COOPERATION IN REMOTE SENSING [INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DER FERNERKUNDUNG]
G. Hildebrandt *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 51-57 ref In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The difficulties encountered in international coordination in this field are discussed. The corresponding programs require infrastructures to be set up enabling ideas to be exchanged on new methods and improvements in existing processes, contacts to be made between specialists, and a framework to be established for defining and carrying out projects. ISP is the organization that best fulfills this task at present, being composed of commissions and subcommissions which cover the subjects of interest. Other organizations such as OEEPE and EARSL have similar coverages. A higher degree of cooperation between these various bodies would be beneficial for all concerned. Concrete examples of world scale projects that could be treated in this way are given. Author (ESA)

N80-12472 Technische Universitaet, Hanover (West Germany).
FROM SATELLITE IMAGES TO AERIAL SURVEY PHOTOGRAPHS: COMPARISON BETWEEN OBSERVATIONS OF THE JADE REGION MADE WITH DIFFERENT SENSORS

[VOM SATELLITENBILD ZUR REIHENMESSKAMER - AUFNAME: DAS JADEGEBEIT IM VERGLEICH UNTERSCHIEDLICHER SENSOREN]

H. P. Baehr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 59-69 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The suitability of images obtained with an aerial survey camera, a Hasselblad camera (with a frog's eye lens), an M sup(2)S multispectral scanning camera and a LANDSAT camera for obtaining specific types of information was investigated. The characteristics (spectral sensitivity, resolution, surface area covered, image information content, geometrical quality, average errors and data processing costs) are presented in a table. Both visible and infrared techniques are employed. Author (ESA)

N80-12473 Deutsches Hydrographisches Institut, Hamburg (West Germany).

SCANNER COORDINATION PROBLEMS: IMAGES FROM OVER THE SEA [ZUORDNUNGSPROBLEME BEI SCANNER - AUFNAHMEN UEBER SEE]

H. Krause and E. Krauth (DFVLR, Oberpfaffenhofen, West Germany) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 71-79 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

In evaluating open sea scanning images, geographical coordination problems are encountered. Discrepancies between ship and theoretically defined air navigation routes are deemed to be the cause. Furthermore, over-scanning introduces image distortion. Navigation difficulties arise from the lack of fixed reference points at sea. Specific problems in the German Bight are analyzed. One solution proposed is to employ greater heights, thus rendering the results less sensitive to flight path deviations. A scan-rate better adapted to the aircraft velocity and height would improve the results. Author (ESA)

N80-12474 Deutsches Hydrographisches Institut, Hamburg (West Germany).

NUMERICAL TREATMENT OF IR THERMAL DATA FOR THE GERMAN BIGHT TEST REGION [NUMERISCHE BEHANDLUNG DER IR-THERMALDATEN AUS DEM TESTGEBEIT DEUTSCHE BUCHT]

G. Becker and K. Huber *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 81-90 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Research to determine up to what extent scanning IR sensors are suitable for accurately determining surface water temperatures is reported. An extensive numerical treatment for such data is presented. Preliminary results indicate that an improvement in the atmospheric correction factor is required. Furthermore, comparisons between IR and conventional temperature distribution measurements enable differences between surface and near surface temperatures to be taken into consideration.
Author (ESA)

N80-12475 Technische Universitaet, Hanover (West Germany).

EVALUATION OF THERMAL IMAGES OF THE JADE REGION [AUSWERTUNG VON THERMALAUFNAHMEN DES JADEGEBIETS]

P. Lohmann *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 91-101 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Differences are observed between ship measurements of the water stratum temperature and the temperatures derived from scanning data. A correction factor is introduced whereby agreement between these two types of measurement can be achieved. The computerized treatment of the corresponding data is described, and an example is given in which a clear enhancement in the quality of the measured parameter can be seen.
Author (ESA)

N80-12476 Technische Universitaet, Hanover (West Germany).

DETERMINATION OF CURRENTS IN COASTAL REGIONS USING MULTISPECTRAL SCANNING IMAGES [STROEMUNGSUNTERSUCHUNGEN MIT HILFE VON MULTISPEKTRALEN SCANNERAUFNAHMEN IM KUESTENGEBEIT]

D. Kolouch *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 103-112 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The determination of current directions and speeds in the Jade region is very important in understanding sediment transport. The various clouds of troubled water have to be distinguished from one another (in this region, 95% of such clouds is due to clay minerals). A laboratory developed method shows that maximum contrast is obtained with three wavelength channels: 600, 850 and 1085 nm. Plotting the results, and their evaluation with a DIBIAS system are also discussed. Examples are given.
Author (ESA)

N80-12477 Wasserwirtschaftsamt Wilhelmshaven (West Germany).

WATER QUALITY IN COASTAL REGIONS: EVALUATION OF THERMAL IMAGES OF FACTORY WATER COOLANT INLETS [WASSERGUETE IM KUESTENBEREICH: AUSWERTUNG VON THERMALAUFNAHMEN DES KUEHLWASSEREINLAUFS EINES KRAFTWERKS]

H. Regehly *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 113-121 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The rapid industrialization of the Jade coast at Wilhelmshaven is resulting in a detrimental biotope distribution in the Jade. Water quality must therefore be controlled. The use of aerial photography for this purpose was studied. Particular attention was paid to determining what happens to waste water (flowpaths, time spent in particular regions). Maps and tables showing different sources of contamination are given.
Author (ESA)

N80-12478 Hamburg Univ. (West Germany).

ON THE PROBLEM OF THE REMOTE SENSING OF SUBSTANCES IN WATER BY MULTISPECTRAL SCANNING [ZUM PROBLEM DER FERNERKUNDUNG VON SUBSTANZEN IM WASSER MIT DEM MULTISPEKTRALSCANNER]

R. Doerffer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 123-130 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Measurements devised to determine the characteristics and concentrations of three groups of substances (those producing a yellow/brown coloration, suspended matter and phytoplankton) are described. If qualitative and quantitative information is to be deduced, account must be taken of contributions to the measured signal arising from ground surfaces, interfaces and the atmosphere. Backscattered radiation fields are related to concentration levels. Author (ESA)

N80-12479 Deutsches Hydrographisches Institut, Hamburg (West Germany).

RESEARCH INTO DETERMINING CHEMICAL PARAMETERS AT THE SURFACE OF THE SEA BY REMOTE SENSING [UNTERSUCHUNG ZUR BESTIMMUNG CHEMISCHER PARAMETER VON DER MEERESOBERFLAECHE DURCH FERNERKUNDUNG]

D. Schmidt and K. Struebing *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 131-138 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

In the example selected, regularly introduced quantities of waste solution released by a titanium dioxide fabricant situated in northwest Helgoland since 1969 are studied. Remarkable coloration phenomena are observed; these phenomena have been investigated over a period of several years. Measurements made in the sea and results from aerial and satellite photography are discussed together with image analysis techniques. Images of ships' wakes and their digital treatment are presented.
Author (ESA)

N80-12480# Technische Universitaet, Hanover (West Germany).

COLORED SUBSTANCE MIXING EXPERIMENTS IN THE KIELER BAY TEST REGION. COMPARATIVE EVALUATION

OF MULTISPECTRAL SCANNING AND COLOR SLIDE DATA [FARBSTOFFVERMISCHUNGSEXPERIMENTE IM TESTGEBEIT KIELER BUCHT, VERGLEICHENDE AUSWERTUNG VON MULTISPEKTRALSCANNER- UND FARBDIATEN]

M. Ehlers and P. Haberaecker (DFVLR, Oberpfaffenhofen, West Germany) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 139-142 In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

In the framework of the 1976 FMP campaign, six survey flights, employing both scanning and color aerial photography techniques, were carried out. Various mixing models were used to study these data. No significant differences were observed between the different results obtained. Practical information on the treatment of the information contained in these images is given together with details about image quality. Author (ESA)

N80-12481 Technische Universitaet, Hanover (West Germany).

MULTISPECTRAL CLASSIFICATION OF SAND BANK REGIONS [MULTISPEKTRALE KLASSIFIZIERUNG VON WATTGEBIETEN]

E. Dennert-Moeller and J. Doerjes (Inst. fuer Meeresgeol.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 143-151 In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

The geological dispositions, extent, and nature of individual sand banks are required for ecological research purposes. The maximum likelihood method is applied to RMK and LANDSAT images, and in particular, to M sup(2)S scanning data. An extension of the method for scanning data is indicated. Various photographs of the Jade region are given. It is shown how the different types of sand are identified and classified. Author (ESA)

N80-12482 Technische Universitaet, Munich (West Germany).

QUANTITATIVE DETERMINATION OF MORPHOLOGICAL STRUCTURES IN SAND BANK REGIONS FROM IMAGE STRUCTURE ANALYSIS [QUANTITATIVE ERFASSUNG MORPHOLOGISCHER STRUKTUREN IN WATTGEBIETEN DURCH ANWENDUNG VON VERFAHREN DER BILDSTRUKTURANALYSE]

U. Wieczorek *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 153-164 refs In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

Several factors must be taken into consideration: variations in the altitude of the sun, the position of the object in the image field, the release of residual water from the sand bank's surface, drying out of the sand bank, and relief characteristics (micro, intermediate and macro features). Surface and texture variations are discussed. The way in which the problems encountered are overcome is described together with the computerized treatment of the data obtained. Examples are given. Author (ESA)

N80-12483 Technische Universitaet, Munich (West Germany).

MAKING MORPHOLOGICAL MAPS OF SAND BANKS FROM AERIAL PHOTOGRAPHS [MORPHOLOGISCHE WATTKARTIERUNG NACH LUFTBILDERN]

C. Franke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 165-182 refs In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

Different current distribution and direction regions can be distinguished in aerial photographs of water sand banks. These regions correspond to different sedimentary dispositions of the sand bank surfaces. The materials and methods used are described together with the interpretation of color and texture characteristics. Studies of the Crildumansiel sand banks are treated in detail; the corresponding are given and interpreted. Author (ESA)

N80-12484 Regionale Planungsgemeinschaft Untermain, Frankfurt (West Germany).

FUTURE REMOTE SENSING TASKS IN REGIONAL PLANNING [ZUKUENFTIGE AUFGABEN DER FERNERKUNDUNG IN DER REGIONALPLANUNG]

A. vonHesler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 183-186 In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

Remote sensing techniques when used at the beginning of a whole variety of projects can provide notable advantages. Country, regional and town planning activities have, up until now, because of increasing population characteristics, employed quantitative planning procedures. The need for qualitative planning is becoming increasingly apparent. Financial and administrative problems are ever present. The maximum efficiency in the use of the information so acquired is essential. Suggestions put forward include promoting the availability of DIBIAS systems among experimental workers, making aircraft flights more easily available and encouraging exchanges of information. Author (ESA)

N80-12485 Ruhr Planning Authority, Essen (West Germany).

INTERPRETATION OF IR AND MSS DATA FOR TOWN AREAS [INTERPRETATION VON IR- UND MSS-DATEN IM STADGEBEIT]

F. H. Hirt and P. Stock *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 187-190 refs In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

While the classification of open spaces and areas of vegetation is relatively easy, it is difficult to identify building and other built-up area elements (such as houses, roads and automobile parks) as they are not associated with any precise spectral characteristics. A maximum likelihood method is used to separate vegetation, asphalt, rooftop and shade. Preliminary experiments using digital data processing suggest important new applications for town and regional planning in builtup areas. Author (ESA)

N80-12486 Deutscher Wetterdienst, Offenbach am Main (West Germany).

A METHOD FOR EVALUATING INFRARED IMAGES TAKING PHOTOGRAPHY, VEGETATION COVERAGE AND BUILDINGS INTO CONSIDERATION [EIN AUSWERTEVERFAHREN FUER INFRAROT-AUFNAHMEN DAS TOPOGRAPHIE, BEWUCHS UND BEBAUUNG BERUECKSICHTIGT]

H. Bartels and P. Keuler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 191-196 refs In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

Measurements were carried out and methods developed in the framework of a program for determining what meteorological data are necessary to interpret thermal images, whether the origin of cold air concentration can be established, whether a relation exists between measured radiation temperatures and air temperatures, whether large nets for determining meteorological parameters can be reduced, and in what way the temporal characteristics of vertically rising warm air are dependent on the nature of the subsoil. Infrared scanning measurements were performed in the lower main region. The coordination between radiation and surface temperatures is not very meaningful in this highly structured region. It is shown that useful information for local climate studies and regional planning can be obtained with the aid of a difference method. Author (ESA)

N80-12487 Freiburg Univ. (West Germany).

INTERACTION BETWEEN AIR AND SURFACE TEMPERATURES DURING THE COURSE OF A DAY AS A FUNCTION SURFACE TYPES AND RELIEF [WECHSELWIRKUNGEN ZWISCHEN LUFT- UND OBERFLAECHENTEMPERATUREN IM TAGESGANG IN ABHAENGIGKEIT VON DER OBERFLAECHENART UND DER LAGE IM RELIEF]

H. Gossmann and D. Ahrens (Landesanstalt fuer Umweltschutz) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 197-206 refs In GERMAN (For primary document see N80-12467 03-43)

Avail: Issuing Activity

The aeration effects of topographical winds in town areas, and the determination of temperature and moisture profiles to investigate the consequences of large sources of combustion gas and water vapor, are of current interest. The differences between the surrounding air and surface temperatures of various objects with varying characteristics located in different topographical regions between the Upper Rhine and the Black Forest were investigated (infrared aerial images). Relations were found between surface temperature scattering, air and surface temperatures, times of day and weather conditions. Author (ESA)

N80-12488 Freiburg Univ. (West Germany).
POSSIBILITY OF OBTAINING INFORMATION ON COLD AIR CONCENTRATIONS AND MOVEMENTS FROM THERMAL IMAGES [MOEGLICHKEITEN DES NACHWEISES VON KALTLUFTSAMMELGEBIETEN UND KALTLUFTBEWEGUNGEN AUS THERMALBILDERN]
W. Nuebler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 207-216 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

A surface temperature distribution model was developed from which the origin and characteristics of cold air concentrations can be determined. The use of the DIBIAS system to obtain the required information is described. Details about the terrain investigated are necessary. Additional ground level information such as wind speeds is desirable. Various images of the Freiburg region are treated as examples and the corresponding equidensity maps established. Author (ESA)

N80-12489 Freiburg Univ. (West Germany).
THERMAL IMAGES AND CLIMATIC CHANGES IN REGROUPED VINEYARDS ON MOUNTAIN SLOPES [THERMALBILDER UND DIE VERAENDERUNG DES GELAENDEKLIMAS IN FLURBEREINIGTEN WEINBERGEN]
W. Endlicher *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 217-226 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

As a result of the regrouping policy followed in Kaiserstuhl, conventional small exploited zones have been converted into larger zones. Thermal images and air temperature profiles were obtained and equidensity maps established using the DIBIAS system. Climatic changes are seen to have occurred. It is concluded that greater care should be exercised when developing such zones and that emphasis should be given to ecologically acceptable solutions. Author (ESA)

N80-12490 Freiburg Univ. (West Germany).
LARGE SCALE THERMAL IMAGES AS A MEANS OF DISTINGUISHING BETWEEN BUILDING STRUCTURES IN A TOWN [GROSSMASSTAEBIGE THERMALBILDER ALS HILFMITEL ZUR DIFFERENZIERUNG VERSCHIEDEN STRUKTURIERTER BAUKOERPER EINER STADT]
A. Gehrke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 227-236 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Small scale thermal pictures give false impressions about thermal conditions in town regions because of their oversensitivity to roof tops and large exposed areas and their inability to penetrate narrow streets and suchlike. Large scale photographs obtained at low altitudes yield much more detail. Concrete examples in the Freiburg region are studied. The DIBIAS system is used to interpret data. Microdensitometry profiles are presented. An accurate overall view of the thermal conditions prevailing in a town can be established by combining these measurements with data obtained at ground level. Author (ESA)

N80-12491 Karlsruhe Univ. (West Germany).
DETERMINATION OF THE CHARACTERISTICS OF DIFFUSION PROCESSES AT COOLING WATER INLETS IN THE RHINE AND MAIN [UNTERSUCHUNGEN VON AUSBREITUNGSVORGAENGEN AN KUEHLWASSEREINLEITUNGEN AM RHEIN UND MAIN]
J. Grimm-Strele and H. Kellersmann *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 237-247 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Water mixing behavior is of interest in regional planning and in studying the overall thermal charging to which industry subjects rivers. Various IR scanning data were used to determine diffusion coefficients in a given section of river from which generalized properties applicable to other waterways were established. The theoretical basis of the problem is exposed and discussed. The DIBIAS system is used to exploit some of the data acquired. Author (ESA)

N80-12492 Forschungsinstitut Senckenburg, Frankfurt (West Germany).
STUDIES OF THERMAL DIFFUSION PROCESSES NEAR COOLING WATER INLETS IN A BANKED RIVER (LOWER MAIN) [UNTERSUCHUNGEN UEBER THERMISCHE AUSBREITUNGSVORGAENGE BEI KUEHLWASSEREINLEITUNGEN IN EINEN GESTAUTEN FLUSS (UNTERMAIN)]
W. Tobias and P. Burwitz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 249-256 refs In GERMAN Sponsored jointly by DFVLR, Oberpfaffenhofen, West Ger., and Umlandverband (RPU) (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Accurate information was sought on the behavior of cooling water. The DIBIAS system was used to exploit IR scanning data in the region of a large power plant. The results obtained were complemented with ground truth data. The various factors affecting the distribution and mixing are presented: water flow characteristics, hydrostatic factors (locks, weirs) boat traffic, profile flow and river bed interactions, the effects of removing and reintroducing cooling water, density, viscosity, etc. of cooling water, meteorological biological and ecological parameters.
Author (ESA)

N80-12493 Freiburg Univ. (West Germany).
INTERPRETATION OF WATER QUALITY USING REMOTE SENSING TECHNIQUES [ZUR INTERPRETATION DER QUALITAET VON WASSERKOERPEN AUS FERNERKUNDUNGSAUFZEICHNUNGEN]
H. Dietze, G. Hildebrandt, and D. Mahr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 257-270 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Characteristics of large water surfaces and waterways were investigated using an eleven channel multiscanner and from aerial photographs taken at different heights and times of the year. The results obtained show how information in the near infrared is influenced by high absorption. A more realistic interpretation of the results obtained can be achieved by employing a VP 8 analog evaluation system. A table of measured characteristics for eutrophic and non-eutrophic water masses is presented.
Author (ESA)

N80-12494 Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
DETERMINATION OF SOIL WATER CONTENTS FROM RADIOMETRIC MEASUREMENTS AND IR SCANNING DATA [ERMITTLUNG DES WASSERGEHALTES VON BOEDEN MIT HILFE RADIOMETRISCHER MESSUNGEN UND IR-SCANNERDATEN]
J. Nithack *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 271-280 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Research conducted in the FMP4 test region demonstrated that data obtained from thermal images are insufficient to perform quantitative moisture calculations from vegetation covered regions. Temperature gradients (temperature variations/unit time) in uniformly vegetation covered regions only provide quantitatively different information for water contents up to 25% (by weight). Soils can be classified and correction data established from statistically processed temperature gradient information. Temperature gradient maps can, however, only be used as a basis for determination, warm air concentrations relative to surface moisture characteristics. They are most useful for classifying soils. High aerial soil moisture content measurements which take energy flux into consideration can provide information about soil depths up to 15 cm. However, a great number of measurements are required and it is dubious whether such a procedure is worthwhile. Author (ESA)

N80-12495 Landeskulturamt Hessen, Wiesbaden (West Germany).
CLASSIFICATION OF AGRICULTURAL LAND WITH THE AID OF REMOTE SENSING METHODS [KLASSIFIZIERUNG AGRARISCHER LANDNUTZUNG MIT HILFE VON FERNERKUNDUNGSMETHODEN]
P. Richtscheid *In* Tech. Hochschule On Meas. from Aircraft

Jun. 1978 p 281-286 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Visual images of exploited land in the Rhein-Main region and around Wetterau were recorded and compared with scanning data and various photographs. Data obtained from flights in 1976 and May 1977 are interpreted. In spite of the unfavorable vegetation development periods during which data were recorded, it was possible to distinguish between different types of culture with the aid of the DIBIAS system. It is suggested that flights should either be more accurately synchronized with agricultural development phases, or that a program of regular flights should be set up. Author (ESA)

N80-12496 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AERIAL PHOTOGRAPHY OF AGRICULTURAL FARMING LAND [UNTERSUCHUNG VON LUFTBILDERN LANDWIRTSCHAFTLICHER KULTUREN]
H. Helbig *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 287-294 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Work conducted in the framework of a program for the recognition and determination of plant protection procedures and manure effects is described. Land divided into 2 x 5 sq m plots was studied. Various photographic conditions and vignetting effects made interpretation difficult. A procedure was developed to correct such effects, which relies on information contained in the image itself, and does not require any further measurement data. Author (ESA)

N80-12497 Badische Anilin- und Soda-Fabrik A.G., Landwirtschaftliche, Giessen (West Germany).
FEASIBILITY OF USING REMOTE SENSING FOR DETERMINING NUTRITIONAL REQUIREMENTS, DISEASES AND PST INFESTATIONS IN AGRICULTURAL CROPS [MOEGLICHKEITEN DER FERNERKUNDUNG ZUR BESTIMMUNG VON NAEHRSTOFFVERSORGUNG, KRANK-HEITS- UND SCHAEDLINGSBEFALL AN LANDWIRTSCHAFTLICHEN KULTUREN]
K. H. Schneider *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 295-305 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The radiobiological behavior of crops in the IR and visible spectrum was studied. It is shown that measurements made during the 1976 summer FMP program are satisfactory for classifying different types of culture. Concrete examples with various crops are presented and examined. The biological processes taking place are considered. In one case, it was possible to distinguish between different varieties of oats. It was, however, not possible to determine nutrition requirements for the dry 1976 summer. It was possible, though, in one instance, to detect pest infestation in winter corn. The results obtained indicate that optimum information is acquired from low altitude vertical flights. The data obtained must be processed quickly.
Author (ESA)

N80-12498 Freiburg Univ. (West Gennany).
TEXTURE ANALYSIS AS A RECOGNITION PARAMETER FOR DIFFERENT TYPES OF FORESTS [ANALYSE DER TEXTUR ALS ERKENNUNGSPARAMETER ZUR IDENTIFIZIERUNG VON WALDTYPEN]
S. A. Masumy and G. Hilderbrandt *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 307-317 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

It is shown that quantitative and qualitative determinations of forest characteristics from textures are highly dependent on the sensors used and the aircraft altitudes, and at low altitudes, on the position within the image. Examples are given of results obtained using photographic and scanning techniques at varied heights with different forests. Similarities are observed between the values of defined texture parameters determined at given heights with these two techniques. Author (ESA)

N80-12499 Freiburg Univ. (West Germany).
PHENOLOGY AS A FACTOR IN THE DETERMINATION OF DIFFERENT FORMS IN VEGETATION BY REMOTE SENSING [PHAENOLOGIE ALS EINFLUSSGROESSE FUER DIE FERNERKUNDUNG VERSCHIEDENER VEGETATIONSFORMEN]
H.-J. Doefel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 319-330 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Temporal and spatial variations in vegetation forms were studied. Microdensitometer profile measurements were performed on images obtained by photographic methods, and different emulsions were tested. Specific phenological characteristics were revealed in forest and agricultural zones. Methods are suggested for recording and processing the corresponding information so as to optimize the differentiation between different forms of vegetation. Author (ESA)

N80-12500 Freiburg Univ. (West Germany).
APPLICABILITY OF MULTISCANNING TECHNIQUES IN ESTABLISHING INVENTORIES FOR AGRICULTURAL FARMING AND FORESTRY [EINSATZMOEGLICHKEITEN DES MULTISPEKTRALSCANNERS FUER LAND- UND FORSTWIRTSCHAFTLICHE INVENTUREN]
P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 331-344 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Multiscanning results obtained with a preselected test region are presented. Computerized maximum likelihood and minimum distance methods (DIBIAS system) permit the identification and classification of different crops and types of forest together with the regions over which they extend. The problems encountered and the factors to be taken into consideration are discussed.
Author (ESA)

N80-12501 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
WHAT ARE THE ADVANTAGES OF MULTISPECTRAL CLASSIFICATION? [WAS BRINGT DIE MULTISPEKTRALE KLASSIFIZIERUNG?]
E. Triendl *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 345-350 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Multispectral methods for classifying different crops are compared with classical procedures. The introduction of an ellipsoidal probability distribution enables a critical parametric function to be obtained from mean values and the covariance matrix (maximum likelihood classification). A practical example (bend in the Main, near Frankfort) with two scanning channels is studied. It is concluded that reliability and applicability could be enhanced by combining multispectral methods with local parameters. Author (ESA)

N80-12502 Karlsruhe Univ. (West Germany).
APPLICATION OF A HIERARCHICAL CLASSIFICATION METHOD FOR SPECIAL PROBLEMS [ANWENDUNG EINES HIERARCHISCHEN KLASSIFIZIERUNGSVERFAHRENS BEI SPEZIELLEN PROBLEMEN]
F. Quiel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 351-357 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

A hierarchical classification system is described which corrects large direction-dependent variations observed in signals recorded during observation flights. The variations are caused by spectral reflection orientation, atmospheric effects, and other factors. Possibilities such as using texture parameters and the DIDAK data evaluation system are discussed. Practical examples are studied and results are given. Author (ESA)

N80-12503 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
INTERACTIVE CORRECTION OF CLASSIFIED PHOTOGRAPHS [INTERAKTIVE KORREKTUR KLASSIFIZIERUNG BILDER]
G. Kritikos *In* Tech. Hochschule On Meas. from Aircraft Jun.

1978 p 359-366 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

It is shown that badly classified photographs can be corrected with an image modification program. This program is based on the differences between qualitative human appreciation of given situations and quantitative computer evaluations. Examples are given. Author (ESA)

N80-12504 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DEVELOPMENT OF PROCESSING METHODS FOR IMAGES OF THE JADE COAST REGION AND EXPERIENCE ACQUIRED [METHODENENTWICKLUNG UND ERFAHRUNGEN MIT DER BILDVERARBEITUNG IM KUESTENBEREICH DER JADE]
P. Nowak *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 367-370 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The programs and methods developed in conjunction with investigations of the Ostfriesisches sand bank zone are presented. The work relates to magnetic tape interfaces for image processing, thermal mapping of coastal regions, determination of moisture and vegetation in sand bank regions, classification of sand bank by multispectral techniques, research into water currents, and radiometric and geometric corrections. The applications of the DIBIAS system for determining the required parameters is discussed. Author (ESA)

N80-12505 Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
DIGITAL PROCESSING PROCEDURE FOR TEXTURE ANALYSIS WITH REMOTE SENSING DATA [VERFAHREN DER DIGITALEN BILDVERARBEITUNG ZUR TEXTURANALYSE VON FERNERKUNDUNGSDATEN]
B. Bargel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 371-378 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Specific texture parameters were determined and an appropriate combination of parameters was selected in order to classify objects with the use of multispectral analysis. Forest and built-up regions were investigated. The methods employed involve gray scale evaluations, differenciating image data, line information and Fourier spectrum techniques. Preprocessing and image transformation procedures are applied. Some concrete examples and their treatments are presented. Author (ESA)

N80-12506 Technische Universitaet, Hanover (West Germany).
GEOMETRICAL RESTITUTION OF MULTISPECTRAL SCANNING IMAGES [GEOMETRISCHE ENTZERRUNG MULTISPEKTRALER ABTASTERAUFNAHMEN]
W. Schuhr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 379-387 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Programs are developed for the digital restitution of multispectral aerial photographs using direct and indirect methods. Data recorded during flights, DGM, and sequential tapes are used for the restitution. Parameters are obtained for collinear equations in the development of a system of rigorous equations. An example in the Freiburg test region is treated. Application to future developments with other sensors in aerial, radar, and sonar fields are mentioned. Author (ESA)

N80-12507 Karlsruhe Univ. (West Germany).
EVALUATIONS IN THE FRAMEWORK OF THE FMP PROGRAM USING THE DIGITAL IMAGE PROCESSING SYSTEM DIDAK [AUSWERTUNGEN FUER DAS FLUGZEUGMESSPROGRAMM MIT DEM DIGITALEN BILDVERARBEITUNGSSYSTEM DIDAK]
J. Wiesel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 389-394 ref In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The operation and setting up of the DIDAK system is described. The largest part of the program is written in UNIVAC FORTRAN 5 and a smaller part is written in assembly language. Input, processing, and output functions are assured. The central storage contains information about input data, status, observation windows, specification and number of channels, types of image (FMP, LANDSAT, etc), descriptive texts, grayness histograms, classification and results, and geometral information. Examples of boundary extraction and image restitution are presented. Author (ESA)

N80-12508 Freiburg Univ. (West Germany).
CORRESPONDENCE PROBLEMS IN POLYGONAL SEGMENTED MULTISPECTRAL DIGITAL IMAGES [ZUORDNUNGSPROBLEM IN POLYGONAL UNTERTEILTEN MULTISPEKTRALEN DIGITALEN BILDERN]
G. Lange *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 395-404 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

General considerations on the shape of polygonal segments of a digital image are presented from which it is possible to deduce what information can be introduced into the corresponding system by the user, or be extracted from it. Classification problems related to images and their division into polygonal segments are discussed. A model developed for handling data that is meaningful without being in a generic order in a data bank is presented. Some specific problems are tested. Author (ESA)

N80-12509 Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
PRELIMINARY RESULTS ON THE USE OF DIGITAL METHODS WITH CENTER OF GRAVITY DATA REDUCTION IN A PRE-ALP TEST REGION [VORLAEUFIGE ERGEBNISSE IN DER ANWENDUNG DIGITALER VERFAHREN MIT SCHWERPUNKT DATENREDUZIERUNG IN EINEM VORALPEN-TESTGEBIET]
R. Haydn, S. Fernandez, M. Seiderer, and K. A. Ulbricht (DFVLR, Oberpfaffenhofen, West Ger.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 405-411 ref In GERMAN (For primary document see N30-12467 03-43)
Avail: Issuing Activity

The application of a typical element recognition method involving the optimum choice of channels to a particular multispectral scanning data reduction problem is described. Two fundamental requirements for this method to be valid are that the gray values used for classification obey a Gaussian distribution and that after the choice of channels, only the maximum likelihood method is used. Comparisons were made with the principal component method. It is concluded that both methods are valid, the method involving the smallest calculation time being the most appropriate. The above described method is the most suitable for treating the problem considered. Author (ESA)

N80-12510 Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
APPLICATION OF DIBIAS PROGRAMS FOR IMPROVEMENTS AND GEOSCIENTIFIC EVALUATIONS OF LANDSAT PHOTOGRAPHS OF CENTRAL MOROCCO AND SUDAN [DIE ANWENDUNG VON DIBIAS-PROGRAMMEN ZUR VERBESSERUNG UND ZUR GEOWISSENSCHAFTLICHEN AUSWERTUNG VON LANDSAT-BILDERN ZENTRAL-MAROKKOS UND DES SUDAN]
P. Hoppe and K. A. Ulbricht (DFVLR, Oberpfaffenhofen, West Ger.) *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 413-416 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Standard photographs obtained with LANDSAT 1 and 2 were incorporated in the EROS Data Center at Sioux Falls. Joint studies were carried out by DFVLR and BGR on the application of the DIBIAS system to improve image quality and evaluation. Problems ranging from the intensification of image contrast to the development of automatic classification systems are treated. Two test regions were investigated: the vegetation covered region of Central Morocco and the Bayuder desert of Sudan.Author (ESA)

N80-12511 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
DETERMINATIONAL OF SPECTRAL SIGNATURES BY RADIOMETRIC GROUND MEASUREMENTS (REALIZATION

AND PROBLEMS) [BESTIMMUNG SPEKTRALER SIGNATUREN VON BEWACHSENEN OBERFLAECHEN DURCH RADIOMETRISCHE BODENMESSUNGEN (REALISIERUNG UND PROBLEME)]
H. J. Boehnel *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 417-426 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Radiation in the 0.4 to 2.5 nm range reflected from objects and reference standards is studied. The materials used, including the vehicle and mechanical system adopted, are described together with the methods employed to assure the required distances and angles. The measured magnitudes are dependent on many parameters which must be determined for interpretation and classification purposes. The underlying theory is given and characteristic curves for the spectral reflection of fodder beet and corn are presented. Author (ESA)

N80-12512 Institut fuer Physikalische Weltraumforshung, Freiburg (West Germany).
ON THE SIGNIFICANCE OF SPECTRAL SIGNATURES OF VEGETATION COVERED SURFACES IN THE 400-1100 NANOMETER REGION [ZUR SIGNIFIKANZ VON SPEKTRALEN SIGNATUREN BEWACHSENER OBERFLAECHEN IM BEREICHT 400-110 NANOMETER]
W. Fischer *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 427-437 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The effect of the sun zenith and sun azimuth angles on the spectral reflection factors of fodder beet, corn and other crops is investigated using measurements from a spectroradiometer. Overall radiation effects and variations with time of day and seasonal advances were studied. Results obtained, primarily in the Gottenheim region, are presented as a series of curves. The optical directional, and morphological reasons behind the observed variations are discussed. Author (ESA)

N80-12513 Freiburg Univ. (West Germany).
SPECTRAL REFLECTION FROM AGRICULTURAL AND FOREST REGIONS DURING THE VEGETATION PERIOD [SPEKTRALE REFLEXION LAND- UND FORSTWIRTSCHAFTLICHER KULTUREN WAEHREND DER VEGETATIONSPERIODE]
A. Kadro *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 439-448 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Reflection measurements made in the 400 to 1100 nm region with a radiometer are discussed. The highly maneuverable apparatus developed to maintain the radiometer at a height of 17 meters while allowing measurements to be carried out at various angles is described. Investigations, performed on different dates, established typical qualitative and quantitive differences between reflection factor curves corresponding to the different regions studied. Author (ESA)

N80-12514 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
EFFECT OF RADIOMETRIC PARAMETERS ON REMOTE SENSING IMAGES [EINFLUSS RADIOMETRISCHER PARAMETER AUF FERNERKUNDUNGS-AUFNAHMEN]
R. Staetter *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 449-457 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Radiometric parameters, such as atmosphere transmission and scattering, are discussed due to the deterioration of image quality between the object studied and the recording sensor. The signal at the sensor is due to both atmospheric scattering and reflected radiation. When these parameters are known it is shown that remote sensing images can be corrected and signatures improved. Measurements made from LANDSAT (MSS) and NIMBUS in the visible and near infrared, theoretical considerations developed, and the results obtained are discussed.
Author (ESA)

N80-12515 Freiburg Univ. (West Germany).
THE MULTISPECTRAL SCANNER AS AN INSTRUMENT FOR SIGNATURE DETERMINATIONS
P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 459-470 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The identification of objects by multispectral scanning supposes a knowledge of the spectral reflection characteristics of the surface investigated. The determination in situ of these characteristics has the disadvantage of requiring considerable apparatus and employing systems that enable only a few objects to be measured in a working day. A method of overcoming this difficulty is described, which enables various different objects in different regions to be studied under different image conditions. Examples are given. Author (ESA)

N80-12516 Deutsches Hydrographisches Institut, Hamburg (West Germany).
DETERMINATION OF THE OPTICAL PROPERTIES OF THE SEA IN THE GERMAN BIGHT [MEERESOPTISCHE UNTERSUCHUNGEN IN DER DEUTSCHEN BUCHT]
H. Gienapp *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 471-492 refs In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

The spectral distribution, transmission scattering, and CIE coordinate characteristics of the sea were investigated in the framework of the 1976 FMP program. The region between Helgoland and Sylt, and the Elb estuary were studied. The sea on the southern boundary of the Verklappung's region was shown to be very dirty. Relations between color metric magnitudes Gelbstoff, Chlorophyll, and suspended matter contents were shown to exist. Comparisons were made with ERTS satellite photographs. A high degree of correlation in some of these relations was seen for the Elb estuary. The DIBIAS system is used in the calculations performed. Author (ESA)

N80-12517 Institut fuer Angewandte Geodaesie, Singlingen (West Germany).
THE DETERMINATION OF LAND USAGES FOR PLANNING AND CARTOGRAPHY [DIE GEWINNUNG VON NUTZUNGSKATEGORIEN AUS MULTISPEKTRALEN ABTASTERAUFZEICHNUNGEN FUER PLANUNG UND KARTOGRAPHIE]
K. Niemz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 493-500 In GERMAN (For primary document see N80-12467 03-43)
Avail: Issuing Activity

Analog and digital processing of data for regional planning and small scale map production purposes is described. The analog procedure is used for applications with diazo layers in which color compositions are generated. The digital processing employs the DIBIAS system and the maximum likelihood method for classification. Ground maps are produced by both methods. Multispectral scanning and the classification of LANDSAT 2 data are treated. Examples are given covering the classification of a variety of crops. Author (ESA)

N80-12518*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jul. - Sep. 1979
Donald G. Moore, Principal Investigator and J. L. Heilman Sep. 1979 3 p ERTS
(Contract NAS5-24206)
(E80-10002; NASA-CR-162379; SDSU-RSI-79-15) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N80-12519*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY ANALYSIS ON THE POTENTIAL VALUE OF LANDSAT IMAGES FOR A DESERTIFICATION STUDY [ANALISE PRELIMINAR DAS POTENCIALIDADES DAS IMAGENS LAND SAT PARA ESTUDO DE DESERTIFICACAO]

Nelson de.lesusParada, Principal Investigator, Magda Adelaide Lombardo, and Vitor Celso deCarvalho Aug. 1979 40 p refs In PORTUGUESE; ENGLISH summary Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10003; NASA-CR-162380; INPE-1540-RPE/065) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12520*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 2 Oct. 1979 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10004; NASA-CR-162381) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Additional analyses of Luverne, Minnesota ground data revealed that soil moisture variations are independent of elevation effects. Tidal fluctuations in the Potomac River and Delaware Bay were examined as a function of surface temperature. Preliminary findings suggest that temperature boundaries are sufficient to detect various stages of the tidal cycle in Delaware Bay, but are as yet uncertain for prediction in the Potomac River. At least three additional cases are needed to completely evaluate the tidal cycle. An alphanumeric printout at a scale of 1:1,000,000 compares closely with a 1:1,000,000 scale DMD image of the Chesapeake Bay region.

N80-12521*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1979
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1979 14 p Sponsored by NASA ERTS
(E80-10005; NASA-CR-162382) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-12522*# Commission of the European Communities, Ispra (Italy).
MAPPING THERMAL INERTIA, SOIL MOISTURE AND EVAPORATION FROM AIRCRAFT DAY AND NIGHT THERMAL DATA
J. Dejace, Principal Investigator, J. Meger, M. Kohl, G. Maracci, P Reiniger, G. Tassone, and J. Huygen 1978 10 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10006; NASA-CR-162383) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N80-12523*# Commission of the European Communities, Ispra (Italy).
SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979
31 Aug. 1979 50 p refs Sponsored by NASA ERTS
(E80-10007; NASA-CR-162384; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-12524*# Texas A&M Univ., College Station. Remote Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report
J. C. Harlan and D. W. Deering, Principal Investigators Sep. 1979 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20796)
(E80-10008; NASA-CR-162385; RSC-3018-7) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Rangelands in southwest Texas were used to establish threshold values and limitations on measuring herbaceous biomass under typical arid and semi-arid range conditions. Previous regression relationships established between ND6 and green biomass for two different ecosystems were similar. The west Texas data set for brush-free sites was too small to be statistically conclusive. It appears that a line with a third (and steeper) slope would be best for the west Texas data, and that line would intersect the other two. Results show that similar relationships exist between ND6 and green biomass under low brush canopy cover conditions, but local variations require a calibration to determine the best fit for an ecosystem. The brush canopy has a detrimental effect on the ND6 vs. herbaceous green biomass relationship.

N80-12525*# Commission of the European Communities, Ispra (Italy).
JOINT FLIGHT EXPERIMENT UK/1977. REPORT NO. 1: PLANNING AND EXECUTION
P. Reiniger, Principal Investigator Feb. 1977 22 p Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10022; NASA-CR-162394) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12526*# Commission of the European Communities, Ispra (Italy).
TELLUS: A COMBINED SURFACE TEMPERATURE, SOIL MOISTURE AND EVAPORATION MAPPING APPROACH
A. Rosema (EARS, Delft, Netherlands), J. H. Bijleveld (EARS, Delft, Netherlands), P. Reiniger, G. Tassone, K. Blyth (Inst. of Hydrology, Wallingford, England), and R. J. Gurney, Principal Investigators (Inst. of Hydrology, Wallingford, England) 1978 11 p refs Presented at 12th Intern. Symp. on Remote Sensing of Environment, 20-26 Apr. 1978; sponsored by ERIM, Natural Resources Management Center, Philippines, Michigan Univ., AID, Geological Survey, Dept. of Agriculture, NASA, DOE, FHA, Dept. of Interior, DOT, NOAA, TVA, GE Co., Daedalus Enterprises, Inc., Bendix Corp., Taiwan Forestry Bureau and NAC, Inc., Tokyo Sponsored by NASA ERTS
(Proj. TELLUS)
(E80-10023; NASA-CR-162395) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-12527*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
REMOTE ESTIMATION OF SURFACE MOISTURE OVER A WATERSHED M.S. Thesis
Paul Jeffrey Kocin, Principal Investigator Nov. 1979 70 p refs Sponsored by NASA ERTS
(E80-10025; NASA-CR-162368) Avail: NTIS HC A04/MF A01 CSCL 08H

The author has identified the following significant results. Contoured analyses of moisture availability, moisture flux, sensible heat flux, thermal inertia, and day and nighttime temperatures over a Missouri watershed for a date in June and in September show that forests and creeks exhibit the highest values of moisture availability, whereas farmlands and villages are relatively dry. The distribution of moisture availability over agricultural districts differs significantly between the two cases. This difference is attributed to a change in the surface's vegetative canopy between June and September, with higher moisture availabilities found in the latter case. Horizontal variations of moisture, however, do

indicate some relationship between moisture availability and both local rainfall accumulations and the nature of the terrain.

N80-12528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Apr. - 30 Jun. 1979
R. P. Mroczynski, Principal Investigator 30 Jun. 1979 29 p EREP
(Contract NAS9-15325)
(E80-10026; NASA-CR-160348; LARS-063079) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-12529*# Environmental Research Inst. of Michigan, Ann Arbor.
A STUDY OF THE TOLERANCE BLOCK APPROACH TO SPECIAL STRATIFICATION Technical Report, 15 Dec. 1978 - 15 Jun. 1979
W. Richardson, Principal Investigator Aug. 1979 60 p refs EREP
(Contract NAS9-15476)
(E80-10027; NASA-CR-160351; ERIM-132400-25-R) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Twelve winter wheat LACIE segments in Kansas were used to compare the performance of three clustering methods: (1) BCLUST, which uses a spectral distance function to accumulate clusters; (2) blocks-alone, which divides spectral space into equally populated blocks; and (3) block-seeds, which uses spectral means of blocks-alone as seeds for accumulating distance-type clusters. Both BCLUST and block-seeds performed equally well and outperformed blocks-alone significantly. Their average variance ratio of about 0.5 showed imperfect separation of wheat from non-wheat. This result points to the need to explore the achievable crop separability in the spectral/temporal domain, and suggest evaluating derived features rather than data channels as a means to achieve purer spectral strata.

N80-12530*# Texas A&M Univ., College Station. Remote Sensing Center.
THE SYSTEM AND HARDWARE DESIGN OF REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report
John P. Claassen, Robert O. Stroud, Billy V. Clark, B. Randall Jean, and Richard W. Newton, Principal Investigator Mar. 1979 286 p refs EREP
(Contract NAS9-15311)
(E80-10028; NASA-CR-160350; RSC-3556) Avail: NTIS HC A13/MF A01 CSCL 14B

There are no author-identified significant results in this report.

N80-12531*# Commission of the European Communities, Ispra (Italy).
TELLUS NEWSLETTER 1
P. Reiniger, Principal Investigator Oct. 1978 8 p In ENGLISH and FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10029; NASA-CR-162397) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-12532*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RELATIONSHIP OF RED AND PHOTOGRAPHIC INFRARED SPECTRAL DATA TO GRAIN YIELD VARIATION WITHIN A WINTER WHEAT FIELD
C. J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Beltsville Agricultural Res. Center, Md.), and James E. McMurtrey, III (Beltsville Agricultural Res. Center, Md.) Jul. 1979 26 p refs Submitted for publication
(NASA-TM-80328) Avail: NTIS HC A03/MF A01 CSCL 02C

Two band hand-held radiometer data from a winter wheat field, collected on 21 dates during the spring growing season, were correlated within field final grain yield. Significant linear relationships were found between various combinations of the red and photographic infrared radiance data collected and the grain yield. The spectral data explained approximately 64 percent of the within field grain yield variation. This variation in grain yield could not be explained using meteorological data as these were similar for all areas of the wheat field. Most importantly, data collected early in the spring were highly correlated with grain yield, a five week time window existed from stem elongation through antheses in which the spectral data were most highly correlated with grain yield, and manifestations of wheat canopy water stress were readily apparent in the spectral data. Author

N80-12533*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXAMINATION OF LAMBERTIAN AND NON-LAMBERTIAN MODELS FOR SIMULATING THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA
Chris Justice and Brent N. Holben Sep. 1979 25 p refs Submitted for publication
(NASA-TM-80557) Avail: NTIS HC A02/MF A01 CSCL 05B

As a preliminary step to developing a technique to eliminate the topographic effect from remotely sensed data, two radiance simulation models were examined and compared. A Lambertian and a non-Lambertian model were tested using hand-held radiometer measurements from a uniform surface at different slope angle aspect orientations. Linear correlation coefficients for the non-Lambertian model and the field spectra were calculated to be greater than 0.92 for all cases; whereas correlation coefficients for the Lambertian model ranged from 0.06 to 0.98. An assumption regarding an empirical constant within the non-Lambertian equation was found to be invalid and the model was improved by using subsets of the data to derive the empirical value. Author

N80-12534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERIM CALIBRATION REPORT FOR THE SMMR SIMULATOR
P. Gloersen and D. Cavalieri (Systems and Applied Sciences Corp., Riverdale, Md.) Sep. 1979 22 p refs
(NASA-TM-80564) Avail: NTIS HC A02/MF A01 CSCL 14B

The calibration data obtained during the fall 1978 Nimbus-G underflight mission with the scanning multichannel microwave radiometer (SMMR) simulator on board the NASA CV-990 aircraft were analyzed and an interim calibration algorithm was developed. Data selected for the analysis consisted of in flight sky, first-year sea ice, and open water observations, as well as ground based observations of fixed targets with varied temperatures of selected instrument components. For most of the SMMR channels, a good fit to the selected data set was obtained with the algorithm. K.L.

N80-12535*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN CHLOROPHYLL STUDIES FROM A U-2 AIRCRAFT PLATFORM
Hongsuk H. Kim, Charles R. McClain, Lamdin R. Blaine, William D. Hart (Sci. Systems and Applications, Inc., Lanham, Md.), Larry P. Atkinson (Skidaway Inst. of Oceanography, Savannah, Ga.), and James A. Yoder (Skidaway Inst. of Oceanography, Savannah, Ga.) Aug. 1979 37 p refs
(NASA-TM-80574) Avail: NTIS HC A03/MF A01 CSCL 08J

Chlorophyll gradient maps of large ocean areas were generated from U-2 ocean color scanner data obtained over test sites in the Pacific and Atlantic Oceans. The delineation of oceanic features using the upward radiant intensity relies on an analysis method which presupposes that radiation backscattered from the atmosphere and ocean surface can be properly modeled using a measurement made at 778 nm. An estimation of the chlorophyll concentration was performed by properly ratioing radiances measured at 472 nm and 548 nm after removing the atmospheric effects. The correlation between the remotely sensed data and in-situ surface chlorophyll measurements was validated in two

sets of data. The results show that the correlation between the in-situ measured chlorophyll and the derived quantity is a negative exponential function and the correlation coefficient was calculated to be -0.965. R.E.S.

N80-12536*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ANGULAR VARIATION OF SOLAR REFLECTANCE OF SNOW
A. T. C. Chang and B. J. Choudhury (Computer Sciences Corp., Silver Spring, Md.) Oct. 1979 26 p refs
(NASA-TM-80576) Avail: NTIS HC A03/MF A01 CSCL 08L

Spectral and integrated solar reflectance of nonhomogeneous snowpacks were derived assuming surface reflection of direct radiation and subsurface multiple scattering. For surface reflection, a bidirectional reflectance distribution function derived for an isotropic Gaussian faceted surface was considered and for subsurface multiple scattering, an approximate solution of the radiative transfer equation was studied. Solar radiation incident on the snowpack was decomposed into direct and atmospherically scattered radiation. Spectral attenuation coefficients of ozone, carbon dioxide, water vapor, aerosol and molecular scattering were included in the calculation of incident solar radiation. Illustrative numerical results were given for a case of North American winter atmospheric conditions. The calculated dependence of spectrally integrated directional reflectance (or albedo) on solar elevation was in qualitative agreement with available observations. R.C.T.

N80-12537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PASSIVE MICROWAVE REMOTE SENSING OF SOIL MOISTURE: THE EFFECT OF TILLED ROW STRUCTURE
J. R. Wang, R. W. Newton (Texas A and M Univ., College Station), and J. W. Rouse (Missouri Univ., Columbia) Jun. 1979 33 p refs
(NASA-TM-80589) Avail: NTIS HC A03/MF A01 CSCL 08M

The tilled rowstructure is known to be one of the important factors affecting the observations of the microwave emission from a natural surface. Measurements of this effect were carried out with both I and X band radiometers mounted on a mobile truck on a bare 40 m x 45 m row tilled field. The soil moisture content during the measurements ranged from approximately 10 percent to approximately 30 percent by dry weight. The results of these measurements showed that the variations of the antenna temperatures with incident angle theta changed with the azimuthal angle a measured from the row direction. A numerical calculation based on a composite surface roughness was made and found to predict the observed features within the model's limit of accuracy. It was concluded that the difference between the horizontally and vertically polarized temperatures was due to the change in the local angle of field emission within the antenna field of view caused by the large scale row structure. R.E.S.

N80-12538*# Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 1
S. C. Rybak 6 Sep. 1978 410 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161329) Avail: NTIS HC A18/MF A01 CSCL 08I

Candidate vertical control systems (VCS) and face advancement systems (FAS) required to satisfactorily automate the longwall system were analyzed and simulated in order to develop an overall longwall system configuration for preliminary design. R.E.S.

N80-12539*# Bendix Corp., Englewood, Colo. Energy, Environment and Technology Office.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: VERTICAL CONTROL SYSTEM (VCS) Final Report
5 Apr. 1979 196 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161330) Avail: NTIS HC A09/MF A01 CSCL 08I

The prototype preliminary design of the vertical control system (VCS) of the 'automated longwall guidance and control system' is presented. R.E.S.

N80-12540*# Bendix Corp., Englewood, Colo.
AUTOMATED LONGWALL GUIDANCE AND CONTROL SYSTEMS, PHASE 2, PART 2: RCS, FAS, AND MCS Final Report
15 Jun. 1979 315 p Sponsored in part by DOE
(Contract NAS8-32921)
(NASA-CR-161331) Avail: NTIS HC A14/MF A01 CSCL 08I

The prototype preliminary design of the face advancement system (FAS) consisting of the yaw alignment system (YAS) and the roll control system (RCS), and the master control station (MCS) is outlined. R.E.S.

N80-12541# Ohio Dept. of Natural Resources, Columbus. Div. of Geological Survey.
METHOD OF ANALYSIS AND PRECISION OF X-RAY DIFFRACTION DATA FROM OHIO SHALE
R. W. Carlton Oct. 1978 28 p refs
(Contract EY-76-S-05-5200)
(METC/CR-78/16) Avail: NTIS HC A03/MF A01

Sample preparation and methods of calculation used by the Division of Ohio Geological Survey in its mineralogic and physical characterization of the Upper Devonian black shales are described. Methods of sample mounting, used in conjunction with a Philips automatic sample changer (ASC), allow analysis of a large number of samples by X-ray diffractometry. Because of the time saved with an ASC, each sample can be scanned twice to increase the precision of the results. The reproducibility of the X-ray data, expressed as relative deviation, ranges from about + or - 2 to + or - 10 percent in samples for which the percent total integrated intensity (percent TII) is above 6 percent. DOE

N80-12542# Department of Energy, Washington, D. C. Energy Information Administration.
IDENTIFICATION OF A METHODOLOGY FOR PROJECTING SHORT-TERM CRUDE PETROLEUM PRODUCTION IN THE UNITED STATES
N. D. Uri Dec. 1978 35 p
(DOE/EIA-0103/14) Avail: NTIS HC A03/MF A01

Box-Jenkins time series analysis is applied to state level monthly crude petroleum production data to forecast monthly production for 1978. Beyond supplying the requisite forecasts, the model is used to investigate the overall efficacy of the approach. The results indicate that the technique emulates past behavior. Further, for the aggregate United States, production is expected to be 0.65 percent above the level observed in the base period of July 1976 - June 1977 primarily due to a large anticipated growth in California production. DOE

N80-12543# Sandia Labs., Albuquerque, N. Mex. GEO Energy Technology Dept.
OVERVIEW OF IN SITU OIL SHALE TECHNOLOGY AND RECENT ADVANCES IN TRUE IN SITU RETORT MODELING
C. E. Tyner 1979 11 p refs Presented at the 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2367C; CONF-790803-08) Avail: NTIS HC A02/MF A01

In view of current liquid fuel shortages, development of the oil shale resources of Colorado, Utah, and Wyoming, estimated to contain more than one trillion barrels of oil equivalent, is considered. The in situ processing of this resource offers a potentially attractive alternative, both economically and environmentally, to surface processing. True and modified in situ retorting technologies are described and current research in these areas briefly outlined. True in situ and related low-void in situ processes would minimize the mining and materials handling problems associated with other technologies. A comprehensive mathematical model developed to describe the retorting process in these beds is presented. Use of the model to investigate the effect of various retort geometries and bed conditions on the oil yield from true in situ and low-void in situ retorts is discussed. DOE

N80-12544# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
SHALE OIL: US AND WORLD RESOURCES AND PROSPECTS FOR NEAR-TERM COMMERCIALIZATION IN THE UNITED STATES
G. Marland Mar. 1979 59 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-9(R)) Avail: NTIS HC A04/MF A01

Although the United States has large resources of shale oil, several decades of development effort have yet to result in a viable industry. Because both the cost of the oil and the environmental impact of its production are not well known and seem to remain perennially at the margin of acceptability, the matter of commercialization has become a political issue. A variety of economic incentives and government programs to encourage commercial development have been proposed - some implemented - and several industrial corporations are proceeding cautiously. Conflicting political, economic, and environmental views, however, continue to preclude a decisive commitment, and it does not appear at this time that significant quantities of shale oil will be available in the next decade, or probably even longer. DOE

N80-12545# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF A METHOD FOR COMPARING ONE-DIMENSIONAL AND TWO-DIMENSIONAL MODELS OF A GROUND-WATER FLOW SYSTEM
T. G. Naymik 30 Aug. 1978 37 p refs
(Contract W-7405-eng-48)
(UCRL-52541) Avail: NTIS HC A03/MF A01

The inability of a one-dimensional ground-water model to interact continuously with surrounding hydraulic head gradients was evaluated by one- and two-dimensional ground water flow simulations. Two types of models were used: flow-conserving models and models designed to yield two dimensional solutions. The hydraulic conductivities of controlling features were varied and model comparison was based on the travel times of market particles. The solutions within each of the two model types compare reasonably well, but a three dimensional solution is required to quantify the comparison. DOE

N80-12546# National Oceanic and Atmospheric Administration, Washington, D. C.
SEASAT: GULF OF ALASKA EXPERIMENT. SURFACE TRUTH DATA INVENTORY
John C. Wilkerson and S. Lynn McNutt 15 Feb. 1979 100 p
(PB-294616; NOAA-79031609) Avail: NTIS HC A05/MF A01 CSCL 05B

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. J.M.S.

N80-12547# Geological Survey, Reston, Va.
U. S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: BEAVER CREEK WATERSHED
Janet Bonner, comp. 1979 89 p refs
(PB-297442/6) Avail: NTIS HC A05/MF A01 CSCL 08B

Remotely sensed data gathered from spacecraft and aircraft is presented. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.

N80-12548 Carnegie-Mellon Univ., Pittsburgh, Pa.
FOAM SOLAR SEA POWER: A PHYSICAL INVESTIGATION
Ph.D. Thesis
Martin Greenstein 1979 151 p
Avail: Univ. Microfilms Order No. 7925016

A 30 foot high, 4 in. diameter column of glass pipe was constructed. Apparatus to generate a stable fresh water foam was developed and installed at the bottom of the column. An alcohol drip was found to effectively break foam. This, along with a spray condenser, was installed at the column top. Noncondensible gases were removed from the system by a vacuum pump. Water at 25 C. injected into the bottom of the column, was converted to a foam which flowed towards the 5 C condenser. This flow was found to have a dissipative loss similar to that of laminar flow of liquids in pipes. It was concluded that flow losses should not prevent the successful construction of a scaled-up foam solar sea power plant. Dissert. Abstr.

N80-12549*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SCHOTTKY BARRIER SOLAR CELL AND METHOD OF FABRICATION Patent Application
Richard J. Stirn (JPL) and Yea-chuan M. Yeh, inventors (to NASA)
(JPL) Filed 13 Nov. 1979 33 p
(Contract NAS7-100)
(NASA-Case-NPO-13689-2; US-Patent-Appl-SN-093714) Avail: NTIS HC A03/MF A01 CSCL 10A

A Schottky barrier solar cell is described which consists of a thin substrate of low cost material with at least the top surface of the substrate being electrically conductive. A thin layer of heavily doped n-type polycrystalline germanium, with crystalline sizes in the submicron range, is deposited on the substrate after a passivation layer is deposited on the substrate to prevent migration of impurities into the polycrystalline germanium on a substrate of low-cost conductive material. Then, the polycrystalline germanium is recrystallized to increase the crystal sizes in the germanium layer to not less than 5 microns, and preferably considerably more. It serves as a base layer on which a thin layer of gallium arsenide is vapor-epitaxially grown to a selected thickness. Then, a thermally-grown oxide layer of a thickness of several tens of angstroms is formed on the gallium arsenide layer. NASA

N80-12550# Committee on Science and Technology (U. S. House).
INVENTORY OF ADVANCED ENERGY TECHNOLOGIES AND ENERGY CONSERVATION RESEARCH AND DEVELOPMENT, 1976-1978, VOLUME 1
Washington GPO 1979 859 p refs Prepared by ORNL and DOE for the Comm. on Sci. and Technol., 96th Congr., 1st Sess., Jan. 1979
(GPO-41-481) Avail: SOD HC

Each of 7,339 research projects is described and listed in one of the following nine sections into which the inventory is divided: solar energy, geothermal energy, hydro energy, basic physical research, biomass production/conversion and alternative fuels, electric power engineering, energy storage, energy conversion, and energy management, policy, and conservation. Each section is organized in a two- and three-level hierarchical arrangement. A.R.H.

N80-12551*# Ionics, Inc., Watertown, Mass. Research Div.
ANTON PERMSELECTIVE MEMBRANE
Samuel S. Alexander, Russell B. Hodgdon, and Warren A. Waite Mar. 1979 52 p Sponsored by NASA

(Contract DEN3-1)
(NASA-CR-159599; DOE/NASA/0001-79/1) Avail: NTIS HC A04/MF A01 CSCL 10A

Experimental composite membranes were synthesized on a lab scale consisting of a thin layer of anion permselective resin supported by and bonded to a porous physically strong and conductive substrate film. These showed good selectivity and also substantially lower electrical resistivities than the homogenous candidate membranes optimized in the previous contract. A wide range of resin porosities were examined for three candidate membrane systems, CDIL, CP4L, and A3L to identify the formulation giving the best overall redox cell performance. Candidate anion membranes showed large increases in resistivity after a short time of immersion in concentrated FeCl/HCl solution. Largely on the basis of resistance stability the CDIL formulation was selected as prime candidate and about thirty-five membranes (one foot square) were produced for experimental static and dynamic evaluation. R.E.S.

N80-12552*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PHOTOVOLTAIC POWER SYSTEM IN THE REMOTE AFRICAN VILLAGE OF TANGAYE, UPPER VOLTA
William J. Bifano, Anthony F. Ratajczak, and James E. Martz 1979 17 p refs Presented at UNITAR Conf. on Long-Term Energy Resources, Montreal, 26 Nov. - 7 Dec. 1979 Sponsored in part by AID
(NASA-TM-79318; E-274) Avail: NTIS HC A02/MF A01 CSCL 10B

A photovoltaic (PV) system powering a grain mill and a water pump was installed in the remote West African village of Tangaye, Upper Volta. Village characteristics as well as system design, hardware, installation and operation to date are described. The PV system cost is discussed. A baseline socio-economic study performed and a follow-up study is planned to determine the impact of the system on the villagers. R.E.S.

N80-12553# Air Force Academy, Colo. Research Lab.
THE USAF ACADEMY FLYWHEEL-ELECTRIC CAR PRELIMINARY DESIGN REPORT Progress Report, 1 Oct. 1977 - 31 May 1979
David D. Ratcliff May 1979 47 p refs
(AF Proj. 2303)
(AD-A071242; FJSRL-TR-79-0006) Avail: NTIS HC A03/MF A01 CSCL 13/6

Although problems caused by pollution and declining petroleum reserves have caused renewed interest in electric vehicles, currently-available lead-acid batteries impose performance limitations which are unacceptable to most drivers. These limitations, specifically low range and acceleration, are greatly improved by the addition of a flywheel and continuously-variable transmission to the power train of the of the electric vehicle. This paper describes a low-technology flywheel-electric car built by U.S. Air Force Academy cadets and faculty members in the Department of Physics under funding provided by Frank J. Seiler Research Laboratory. The car design discussed appears to offer the possibility for a four-passenger urban vehicle with a range of 70-100 miles and acceleration performance comparable to that of current sub-compact cars. This performance is achieved with a simple driving system which is comparable to that in current automatic transmission cars. The paper also details the benefits and problems resulting from the low-technology design chosen and provides trade-off analyses on some of the specific problems inherent in the use of a flywheel in the power train of a vehicle. Finally, the paper suggests future improvements which could lower the weight of the vehicle, make the transmission shifting more precise, and improve the performance of the car on grades. GRA

N80-12554# American Univ., Washington, D. C.
ON THE PROPERTIES OF A FUEL CELL ELECTROLYTE Final Report, 10 Jul. 1978 - 15 Jan. 1979
Robert T. Foley Feb. 1979 124 p refs
(Contract DAAK70-78-C-0128)
(AD-A072864) Avail: NTIS HC A06/MF A01 CSCL 10/2

The field of fuel cell electrolytes is surveyed with the objective of learning the deficiencies and good properties of the available systems. The survey included a study of inorganic acids as phosphoric, sulfuric, hydrochloric, perchloric, hydrofluoric and other strong acids; organic acids including sulfonic and carboxylic; alkaline systems; ion exchange membrane systems, solid electrolytes; and molten carbonate systems. Some general and specific conclusions are listed indicating the technical questions to be answered to develop a low temperature organic sulfonic acid system. GRA

N80-12555# EIC, Inc., Newton, Mass.
INVESTIGATIONS OF THE SAFETY OF Li/SOCl SUB 2 BATTERIES Quarterly Report, Dec. 1978 - 30 Mar. 1979
Kuzhikalail M. Abraham, Richard M. Mank, and Gerhard L. Holleck Jul. 1979 64 p refs
(Contract DAAB07-78-C-0564; DA Proj. 1L1-62705-AH-94)
(AD-A072862; DELET-TR-78-0564-2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

Cyclic voltammetry and infrared spectrometry were employed as analytical tools to characterize the reaction products in Li/SOCl2 cells during various modes of operation. Sulfur dioxide is produced during the discharge. The nature of products formed during forced overdischarge depends on whether the cells are cathode or anode limited. Infrared spectral data indicated that Li2S is formed in cathode limited cells during forced overdischarge. On the other hand, there was very little or no Li2S present in cells at the end of discharge or in anode limited cells after forced overdischarge. From anode limited cells, Cl2 and a compound exhibiting IR absorption at 1070 cm(-1) were detected after forced overdischarge. These materials are formed by oxidation reactions at the anode. Analysis of solutions from cells discharged without Li on the anode showed that SO2Cl2, SOCl(-)AlCl4(-), Cl2, a material absorbing at 1070 cm(-1) and probably SCl2 are formed as oxidation products. Some SO2 was also found in these solutions. The products detectable after 'charging' a Li/SOCl2 cell were SO2Cl2, SCl2, and the material exhibiting absorption in the infrared spectrum at 1070 cm(-1). On the basis of materials characterized from IR spectral and cyclic voltammetry data, a mechanism is proposed for the oxidation reactions in SOCl2/LiAlCl4 solutions. GRA

N80-12556# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOELECTROCHEMICAL CONVERSION OF OPTICAL ENERGY TO ELECTRICITY AND FUELS Interim Report
Mark S. Wrighton 8 Aug. 1979 37 p refs Submitted for publication
(Contract N00014-78-C-0630; NR Proj. 051-696)
(AD-A072861; TR-2-ONR) Avail: NTIS HC A03/MF A01 CSCL 10/2

Though the first documented photovoltaic effect is associated with a semiconductor/liquid junction, it has not been until very recently that significant solar energy conversion efficiency could be realized with a photoelectrochemical device. A semiconductor/liquid junction solar cell is one where one or both electrodes in an electrochemical cell is semiconductor such that irradiation of the semiconductor(s) results in the non-spontaneous flow of electric current in the external circuit. Photogeneration of storable chemical fuels in the form of electrolytic products is possible, in addition to the prospect of converting light only to electricity when the redox reaction occuring at one electrode is the reverse of that at the other. The aim of this report is to outline our recent research accomplishments in the field of photoelectrochemistry. Our work in this area began in late 1974 - more than a century after the first studies of photoeffects upon irradiation of an electrode in a cell, and a number of years after modern pioneering studies of semiconductor/liquid interfaces which led to the formulation of our present working hypotheses of such interfaces exposed to optical illumination. GRA

N80-12557# Institute of Gas Technology, Chicago, Ill.
COMMERCIAL APPLICATION OF MOLTEN CARBONATE FUEL CELL SYSTEM
K. F. Blurton and J. R. Peterson 1979 16 p Presented at Energy Technol. Conf. and Exppsition, Washington, D.C., 26 Feb. 1979 Prepared in cooperation with Gen. Elec., Schenectady, N. Y.
(Contract EM-78-C-03-1735)
(CONF-790213-4) Avail: NTIS HC A02/MF A01

The potential applications of molten carbonate fuel cells are

discussed with particular emphasis on the configuration of a dispersed, oil-fueled and a central, coal-fueled base-load power plant. The penetration of these power plants into the utility generation system is described. The status of this technology is reviewed, and the major technology areas currently under investigation are discussed. DOE

N80-12558# Washington State Univ., Pullman. Environmental Research Center.
COMPARISON OF GEOTHERMAL ENERGY WITH COAL, OIL, AND NATURAL GAS FOR SELECTED USES
G. W. Hinman and J. Robertson 1979 102 p refs
(Contract EY-76-S-06-2221)
(DOE/ET-27139-1; RLO/2221-T14/1) Avail: NTIS HC A06/MF A01

Environmental effects and energy efficiencies for geothermal energy, western strip-mined coal, and eastern underground mined coal applied to space heating, process heat, and electric drive were compared. The measure of an environmental effect is the amount of residual material released to the environment, and the measure of energy efficiency is the second law efficiency of the process involved. The results indicate that geothermal energy efficiencies (second law) are higher than those for coal for all three end uses. The environmental effects for geothermal supply systems are smaller than those for coal in the cases of space heat and process heat and are comparable in the case of electric drive. The optimum allocation of a finite geothermal resource and a finite coal resource between space heat and drive has been evaluated from the viewpoint of maximum end use service. The results indicate that, to the extent that location factors permit, geothermal energy should be used for space heat and coal for electric drive. DOE

N80-12559# Sandia Labs., Albuquerque, N. Mex.
BATTERIES FOR SPECIFIC SOLAR APPLICATIONS
R. P. Clark 17 Jul. 1979 24 p Presented at DOE/STOR Flow Battery Proj. Rev., Rockville, Md., 17 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1428C) Avail: NTIS HC A02/MF A01

Reproductions of slides used in an oral presentation are published. Thermal batteries are mentioned, and the program strategy for developing batteries for photovoltaic systems is outlined. DOE

N80-12560# Mobil Tyco Solar Energy Corp., Waltham, Mass.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
30 Apr. 1979 8 p refs
(Contract ET-78-C-03-1846)
(SAN-1846-T1; QPR-1) Avail: NTIS HC A02/MF A01

A review of the ion plating deposition process, in which evaporation of a metal or semiconductor into a glow discharge is used to affect the character and surface bonding of the resulting thin film, is presented. It is noted that ion plating increases the adhesion in the substrate of implanted films compared to evaporated or sputtered films. This greater adhesion allows a greater choice of substrate materials, deposition rates approaching those produced by simple vacuum evaporation methods, and the option of doping. DOE

N80-12561# California Univ., Livermore.
USING SURFACE WATERS FOR SUPPLEMENTING INJECTION AT THE SALTON SEA GEOTHERMAL FIELD (SSGF), SOUTHERN CALIFORNIA
E. Raber, Lawrence B. Owen, and Jackson E. Harrar 10 Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979
(Contract W-7405-eng-48)
(UCRL-83011; CONF-790906-15) Avail: NTIS HC A02/MF A01

It was found that direct injection of untreated makeup water is not feasible for cooling because of high suspended solids loading and potential incompatability problems. However, mixtures of ambient temperature makeup water and higher temperature (80 to 90 C) brine effluent, in a 1:4 mass ratio, are potentially injectable following processing by reaction clarification and granular media filtration. DOE

N80-12562# Argonne National Lab., Ill.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 11: NUCLEAR FISSION PROGRAM SUMMARIES
Jun. 1979 345 p
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-11) Avail: NTIS HC A15/MF A01

Brief management and technical summaries of nuclear fission power programs are presented for nineteen countries. The programs include the following: fuel supply, resource recovery, enrichment, fuel fabrication, light water reactors, heavy water reactors, gas cooled reactors, breeder reactors, research and test reactors, spent fuel processing, waste management, and safety and environment. DOE

N80-12563# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.
EFFECT OF OPERATING TEMPERATURES ON THE COST OF ENERGY FROM SOLAR THERMAL ELECTRIC POWER PLANTS
L. I. Lukens Jul. 1979 88 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0801) Avail: NTIS HC A05/MF A01

The operating temperature of a solar thermal electric power plant controls the efficiency of the collector field, the efficiency of the power generation system and the cost of the thermal energy storage system. The effect of these three items, as temperature is varied, on the annualized cost of energy produced by the system was evaluated for both stand-alone solar and solar diesel hybrid power plants. The type of solar power plant considered was one using a linear focus distributed collector field and a Rankine cycle power generation system. Systems using different collector performance models, Rankine cycle working fluids and thermal energy storage concepts were included in the evaluation. DOE

N80-12564# Midwest Research Inst., Golden, Colo.
THERMOELECTRIC OCEAN THERMAL ENERGY CONVERSION
T. S. Jayadev, D. K. Benson, and M. S. Bohn Jun. 1979 33 p refs Presented at the Sixth Intern. OTEC Conf., Washington, D.C., 19-22 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-254; CONF-790631-6) Avail: NTIS HC A03/MF A01

A novel thermoelectric ocean thermal energy conversion (OTEC) concept was proposed and compared with the ammonia closed-cycle designs. The thermoelectric OTEC was found to offer several potential advantages including: simpler and more easily mass produced components; higher reliability system performance through the use of a high level of redundancy and long-lived, solid state thermoelectric generators; greater safety for crew and environment by elimination of the pressurized safety for crew and environment by elimination of the pressurized working fluid; and the possibility of lower system costs. DOE

N80-12565# Midwest Research Inst., Golden, Colo.
SYSTEMS ANALYSIS AND TESTING (SAT) PROGRAM Progress Report, 1 Oct. 1978 - 31 Mar. 1979
C. J. Bishop Jul. 1979 19 p refs
(Contract EG-77-C-01-4042)
(SERI/PR-35-313) Avail: NTIS HC A02/MF A01

Activities of the systems analysis and testing (SAT) program are described. These include: (1) a reevaluation of thermosiphon hot water systems; (2) a review of existing wind machine performance models; a study of the effects of wind transients, and control system and load management on energy capture; (3) a study of new concepts for solar ponds involving stratified ponds; (4) establishment of the computational methods center; (5) dissemination of F-chart; (6) a review of photovoltaic systems analysis methods; (7) development of a draft SAT program plan, SAT management plan, and an integrated system test and validation plan, and (8) transfer of technical management of contracts in the SAT program. DOE

N80-12566# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMIZATION OF PHOTOVOLTAIC/THERMAL COLLECTOR HEAT PUMP SYSTEMS
M. C. Russell and E. C. Kern, Jr. 1979 5 p refs Presented at the 1979 Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun. 1979
(Contract EG-77-S-02-4577)
(COO-4577-7; CONF-790541-20) Avail: NTIS HC A02/MF A01

Photovoltaic/thermal (PV/T) collector-heat pump systems were simulated for residences in New York and Fort Worth climates. Analysis of the technical and economic results are discussed. The parallel heat pump configuration with 40 square meters of PV/T collectors was found to be the least-cost system option for the New York residence. DOE

N80-12567# Franklin Inst. Research Labs., Philadelphia, Pa.
THE GREAT ADVENTURE: A REPORT ON THE 10 REGIONAL PUBLIC HEARINGS ON SOLAR ENERGY FOR THE DOMESTIC POLICY REVIEW
Oct. 1978 52 p refs Prepared by the Inst. for Local Self Reliance
(Contract EU-78-C-01-6354)
(HCP/U6354-01) Avail: NTIS HC A04/MF A01

A report on the public hearings is presented along with policy recommendations. The recommendations are as follows: (1) the Federal government should move aggressively from research to commercialization, marketing, and public education; (2)decentralization both in program process and in context should be pursued vigorously; (3) the government should emphasize small scale systems, small businesses, individual inventors, community organizations, and small research groups in its funding programs; (4) solar energy systems that are decentralist are preferred over the more central-oriented; (5) passive solar design was the major technology recommended throughout; (6) DOE must streamline its grants process and reduce paperwork that proposals require; (7) the major item required for a successful solar industry is rapid passage of the solar income tax credit, either within, or separate from, the National Energy Act; (8) low interest loans and investiment capital are required by small businesses; (9) public information on solar energy should be more available; (10) the budget for solar should be increased substantially; and (11) solar programs should be related to job-creation programs. DOE

N80-12568# Oak Ridge National Lab., Tenn. Engineering Technology Div.
LOW-TEMPERATURE THERMAL ENERGY STORAGE PROGRAM ANNUAL OPERATING PLAN
H. W. Hoffman and D. M. Eissenberg Jan. 1979 130 p
(Contract W-7405-eng-26)
(ORNL/TM-6605) Avail: NTIS HC A07/MF A01

The LTTES program operating plans for FY 1978 are described in terms of general program objectives and the technical activities being implemented to achieve these objectives. The program structure provides emphasis on seasonal thermal storage, daily/short-term thermal storage, and waste heat recovery and reuse. A work breakdown structure organizes the efforts being carried out in-house or through subcontract within each thrust area. Fiscal data are summarized with respect to thrust area, individual efforts, and funding source. DOE

N80-12569# California Univ., Livermore. Lawrence Livermore Lab.
HYBRID STAGING OF GEOTHERMAL ENERGY CONVERSION PROCESSES
Robert F. Steidel Sep. 1978 27 p refs
(Contract W-7405-eng-48)
(UCID-17949) Avail: NTIS HC A03/MF A01

A hybrid system consists of two or more energy conversion processes. The use is examined of three energy conversion machines in hybrid systems: the conventional single-phase turbine, and the two-phase expanders known as the Lysholm engine and the radial outflow reaction turbine. Two hybrid systems are presented. The first is a two-stage, single-flash system with the Lysholm engine as the first stage, and a separator and conventional turbine as the second stage. The second system adds a radial outflow reaction turbine to recover a part of the energy rejected in the second stage. A theoretical specific power of 41.3 kW.s/lb is predicted for the two-stage, single-flash hybrid system. The addition of the radial outflow rotary turbine increases performance to 44.8 kW.s/lb. Both are superior to the double-flash system, with a specific power of 37.8 kW.s/lb. In addition, the hybrid system offers operating flexibility. DOE

N80-12570# California Univ., Livermore. Lawrence Livermore Lab.
NEW CONCEPTS FOR CONVERTING THE ENERGY IN LOW-TO MEDIUM-TEMPERATURE LIQUIDS, WITH EMPHASIS ON GEOTHERMAL APPLICATIONS
Arthur L. Austin and Palmer A. House 20 Sep. 1978 18 p refs
(Contract W-7405-eng-48)
(UCRL-52583) Avail: NTIS HC A02/MF A01

The Geothermal Development Program at Lawrence Livermore Laboratory has produced several novel expanders for liquids of low to medium temperatures (approximately 180 C). A unique radial outflow reaction turbine (RORT) was developed and laboratory-tested; results indicate that 50% engine efficiency is achievable. This work has led to a new concept called the velocity pump reaction turbine (VPRT), which could significantly increase the gross engine efficiency of the RORT. VPRT and its modifications are a unique family of turbines created specifically for expanding liquids to produce shaft work at potential engine efficiencies of up to 70%. Such devices, if used between the two separation stages of a double-flash system, could increase the overall power output by 15 to 20%, reducing power costs by at least 10% for about a 3% increase in capital costs. Geothermal applications are discussed with emphasis on geopressured resources. Also, these machines are suitable for utilizing solar heated fluids and waste heat sources from industrial processes. DOE

N80-12571# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF SOLAR RANKINE-CYCLE ENGINE SYSTEMS
Gilad Rambach (Ormat Turbines Ltd., Yavne, Israel) Jan. 1979 39 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0986) Avail: NTIS HC A03/MF A01

Electrical parasitic losses are evaluated for two solar Rankine-cycle engine systems: (1) a total-energy solar system for the Midtemperature Solar Systems Test Facility (MSSTF), and (2) the Willard solar irrigation pump. Estimates are given of the minimal electrical parasitic losses that a commercialized total-energy solar system of the size of the MSSTF could have as well as minimal losses for the Willard solar irrigation pump. DOE

N80-12572# Sandia Labs., Albuquerque, N. Mex. Chemical Technology Div.
CLOSED-CYCLE HYDRIDE ENGINES
Thomas E. Hinkebein, Clyde J. Northrup, and Albert A. Heckes Dec. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2228) Avail: NTIS HC A02/MF A01

Closed cycle hydride engines of 1/2 horsepower or less, which are capable of using a low quality heat source available from flat plate solar collectors or from process waste streams, are described. The engines are simple in concept and operation, potentially inexpensive, reliable, and capable of remote unattended operation. They perform work as hydrogen evolved from a heated metal hydride expands against a flexible member. The cycle is completed by the reabsorption of hydrogen in the metal upon cooling. Theoretical cycles are described and efficiencies are presented. A comparison is made to both Carnot and Rankine cycles. DOE

N80-12573# Battelle Pacific Northwest Labs., Richland, Wash.
SPECULARITY MEASUREMENTS FOR SOLAR MATERIALS
M. A. Lind, J. S. Hartman, and H. L. Hampton Aug. 1978 10 p refs Presented at Symp. and Instr. Display, San Diego, Calif., 28 Aug. 1978
(Contract EY-76-C-06-1830)
(PNL-SA-6831-Pt-2; CONF-780829-10) Avail: NTIS HC A02/MF A01

A technique using Fourier transform analysis which is suitable for measuring the specularity of solar glass components in the mrad and sub-mrad is discussed and demonstrated. A brief mathematical background as well as illustrative examples are included. A number of methods for image analysis are discussed with particular emphasis given to electronic integrating detectors. Typical Fourier plane image distributions are given for a few common solar utilization materials and details of the instrument used to produce the images are considered. The limitations and capabilities of various instruments are outlined along with methods for further enhancing the utility and sensitivity of the technique. DOE

N80-12574# Sandia Labs., Livermore, Calif. Exploratory Chemistry Div.
MATERIALS PROBLEMS IN REVERSIBLE CHEMICAL REACTION STORAGE SYSTEMS FOR SOLAR ENERGY
R. W. Mar Nov. 1978 17 p Presented at Mater. Sci. Conf., Argonne, Ill., 1 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-8693; CONF-7806127-1) Avail: NTIS HC A02/MF A01

Materials problems encountered in the development of thermochemical energy storage systems for solar energy are discussed. Concerns with catalyzed reaction systems include effects of thermal cycling on reactor materials, catalyst availability and lifetime, and undesirable side reactions. Problems have arisen in thermal decomposition systems due to poor or variable kinetics, volume expansion effects, and poor intrinsic heat transfer properties. Reactions which make use of the heat of solution suffer least from materials problems; the major concerns are with the corrosive nature of the chemicals involved (e.g., sulfuric acid, sodium hydroxide). DOE

N80-12575# Oak Ridge National Lab., Tenn. Energy Div.
WASTE HEAT REJECTION FROM GEOTHERMAL POWER STATIONS
R. C. Robertson Dec. 1978 159 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6533) Avail: NTIS HC A08/MF A01

Waste heat rejection from geothermal power stations is concerned only with the heat rejected from the power cycle. The heat contained in reinjected or otherwise discharged geothermal fluids is not included with the waste heat considered here. The heat contained in the underflow from the flashtanks in such systems is not considered as part of the heat rejected from the power cycle. By following this definition of the waste heat to be rejected, various methods of waste heat dissipation are discussed without regard for the particular arrangement to obtain heat from the geothermal source. Recent conceptual design studies made for 50 MW(e) geothermal power stations at Heber and Niland, California, are of particular interest. The former uses a flashed-steam system and the latter a binary cycle that uses isopentane. In last-quarter 1976 dollars, the total estimated capital costs were about $750/kW and production costs about 50 mills/kWhr. If wet/dry towers were used to conserve 50% of the water evaporation at Heber, production costs would be about 65 mills/kWhr. DOE

N80-12576# Ames Lab., Iowa. Solar Div.
OPERATIONAL EXPERIENCE WITH DRAIN-DOWN SOLAR SYSTEMS
P. H. Sidles, R. G. Struss, and E. C. Brohl 1978 11 p ref Presented at Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, Colo., 29 Nov. 1978
(Contract W-7405-eng-82)
(IS-M-168; CONF-781102-3) Avail: NTIS HC A02/MF A01

Drain-down solar collector systems offer substantial economic advantage over antifreeze/heat-exchange systems. Drain-down systems are simpler, have lower piping and plumbing costs, and operate at higher collector and system efficiencies. Properly designed and installed drain-down systems intrinsically should require less maintenance. These advantages have not yet been demonstrated in actual operating experience. A substantial number of the Solar Heating and Cooling Demonstration projects under Ames Laboratory cognizance are of drain-down design. Most projects are located in freezing climates; some suffered damage from freezing last winter. Operating experiences for these projects are presented, together with some design criteria for drain-down systems that these operating experiences reveal. DOE

N80-12577# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE OF LOS ALAMOS SOLAR MOBILE/MODULAR HOME UNIT NO. 1
J. C. Hedstrom, S. W. Moore, and J. D. Balcomb 1978 7 p Presented at Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, Colo., 29 Nov. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2587; CONF-781102-1) Avail: NTIS HC A02/MF A01

Mobile/Modular Home Unit No. 1 at the Los Alamos Scientific Laboratory is an active air system which incorporates 340 sq ft of flat black single-glazed flat-plate air collectors mounted at a 60 tilt on the south wall. The thermal storage is in 1536 pint jars of water spaced apart by 5/8 in. to allow air flow around the jars. Data have been obtained on the unit from October 1976, up to the present. Data acquisition is by a Hewlett-Packard 3050 system controlled with a HP9825 desk top calculator. Complete energy summaries for the heating seasons have been obtained. The solar energy system has provided about 70% of the heating requirements of the house each season. Although the solar energy system provides a major fraction of the space and domestic hot water requirements, the yearly total energy supplied is low. This is primarily because the house load was lower than expected due to passive gains and internal heat generation. Low performance is also due to a low storage mass (5.3 Btu/sq ft F) and several possible uncontrolled air leaks. DOE

N80-12578# Midwest Research Inst., Golden, Colo.
DIRECT LABOR REQUIREMENTS FOR SELECT SOLAR ENERGY TECHNOLOGIES: A REVIEW AND SYNTHESIS
B. Mason and K. Armington Aug. 1978 32 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-53-045) Avail: NTIS HC A03/MF A01

Various estimates of the labor requirements for the design, manufacture, installation, and maintenance of space heating and domestic hot water systems are presented. Total projected job requirements by year, calculated by multiplying person-hours per system times market penetration estimated, are provided. Limitations of previous studies and conclusions about needed research are discussed. DOE

N80-12579# Sandia Labs., Albuquerque, N. Mex. Div. 4715.
EFFORTS ON THE ECONOMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINES
W. N. Sullivan 1978 8 p ref Presented at Am. Wind Energy Assoc. Conf., Hyannis, Mass., 25 Sep. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1851C; CONF-780972-1) Avail: NTIS HC A02/MF A01

There is an ongoing program designed to establish reasonable estimates for the cost of utility grid energy produced by Darrieus VAWT systems. The economic analysis is based on the detailed examination of actual point designs, which cover a range of system sizes. The approach is unique in that in addition to determining the direct costs of system components, an effort is made to include the indirect costs and profits of the manufacturing, marketing, distributions, and sales tasks of the enterprise producing the systems. The point design specifications and drawings were developed and provide the baseline for this study. The specifications represent optimum designs, as determined by an economic optimization model. This model, with mathematical formulas for the costs of major system elements, was used to select from many possibilities an optimum set of design specifications. DOE

N80-12580# Oak Ridge National Lab., Tenn. Energy Div.
FUEL CHOICE AND AGGREGATE ENERGY DEMAND IN THE COMMERCIAL SECTOR
Steve Cohn Dec. 1978 51 p refs
(Contract W-7405-eng-26)
(ORNL/CON-27) Avail: NTIS HC A04/MF A01

A fuel choice and aggregate demand model of energy use in the commercial sector of the United States is presented. The model structure is dynamic with short run fuel price responses

estimated to be close to those of the residential sector. Of the three fuels analyzed, electricity consumption exhibits a greater response to its own price than either natural gas or fuel oil. In addition, electricity price increases have the largest effect on end use energy conservation in the commercial sector. An improved commercial energy use data base is developed which removes the residential portion of electricity and natural gas use that traditional energy consumption data sources assign to the commercial sector. In addition, household and commercial petroleum use is differentiated on a state by state basis. DOE

N80-12581# Ernst and Ernst, Washington, D. C.
DEVELOPMENT OF A JOINT-COST-ALLOCATION MANUAL FOR INTEGRATED COMMUNITY ENERGY SYSTEMS (ICES)
Sep. 1978 117 p refs
(Contract W-31-109-eng-38)
(ANL/ICES-TM-20) Avail: NTIS HC A06/MF A01

The problem of an appropriate-cost-allocation system for an integrated community energy system was studied. Technical factors were examined and the relevant economic theory was synthesized. Three generic approaches to cost allocation (public projects, cost accounting, mathematical programming) were assessed and current utility and regulatory allocation procedures were surveyed. Based on these steps, conclusions to date are: (1) economic theory suggests that cost allocation is unnecessary for optimal feasibility, pricing, and output decisions; (2) reasonable and practicable allocations are required for regulatory purposes and cost-sharing arrangements; (3) no single approach to cost allocation in practice is wholly satisfactory; (4) the mathematical programming approach seems most promising at this juncture; and (5) implementation of any method is dependent on data availability. DOE

N80-12582# Department of Energy, Washington, D. C. Economic Regulatory Administration.
STANDBY CONSERVATION PLAN NO. 2: EMERGENCY BUILDING TEMPERATURE RESTRICTIONS. AUTHORITIES: NEED, RATIONALE, OPERATION
Feb. 1979 29 p
(DOE/ERA-0048) Avail: NTIS HC A03/MF A01

The text of the Emergency Building Temperature Restrictions is given. The text includes definitions, heating and cooling, hot water, reports and recordkeeping, operators, customer lists, relation to state law, administrative provisions, public information, and penalties. The statement of the need for rationale and operation of the plan is also given. The plan applies in each state or political subdivision thereof and preempt inconsistent state or local law. DOE

N80-12583# Department of Energy, Washington, D. C. Office of Fusion Energy.
UNITED STATES MAGNETIC FUSION ENERGY PROGRAM
S. O. Dean Aug. 1978 176 p
(DOE/ET-0072) Avail: NTIS HC A09/MF A01

The following topics are discussed: (1) policy; (2) magnetic fusion energy program; (3) physics proof-of-principle programs; (4) major scaling experiments; (5) energy producing experimental reactors: design studies and long lead time technology development; (6) commercialization: reactor designs and systems studies; and (7) enhancement studies. DOE

N80-12584# California Univ., Livermore. Lawrence Livermore Lab.
NOTES FROM THE SECOND DEPARTMENT OF ENERGY LIBRARY WORKSHOP
K. W. Fong and R. E. Jones Oct. 1978 15 p Presented at ACM-SIGNUM Conf. on the Programming Environment for Develop. of Numerical Software, Pasadena, Calif., 18 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81736; CONF-781052-4) Avail: NTIS HC A02/MF A01

Problems posed by the proliferation of minicomputers of different models and supercomputers of unconventional architecture are discussed. The role of commercial libraries in the operation of DOE computer center libraries is examined. A number of suggestions with respect to the format of software submitted to libraries are explained. DOE

N80-12585# IBM Federal Systems Div., Huntsville, Ala.
OCTOBER 1978 ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Oct. 1978 176 p refs
(Contract EG-77-C-01-4049)
(SOLAR/0010-78-10) Avail: NTIS HC A09/MF A01

The thermal performance of selected solar energy systems was determined. The energy contribution of each solar energy system was also determined. DOE

N80-12586# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL TEST FACILITY FOR EVALUATION OF SOLAR CONTROL STRATEGIES
M. Majteles, H. Lee, M. Wahlig, and M. Warren 15 Aug. 1978 11 p Presented at Workshop on the Control of Solar Energy, Hyannis, Mass., 23 May 1978
(Contract W-7405-eng-48)
(LBL-8308; CONF-7805126-5) Avail: NTIS HC A02/MF A01

An experimental solar heating and cooling system was constructed. It was designed to serve as a test system to check out the operation of a solar controller that looked promising in terms of its commercialization potential. Improvements were made in the experimental heating and cooling system to enable quantitative determination of the auxiliary energy savings made possible by using this type of controller. These improvements consisted of installation and calibration of accurate instrumentation, data acquisition capabilities, and development of simulated input and output devices that would allow repeated experiments using the same running conditions. In addition, the possibilities of further development of the heating and cooling system into an experimental test facility for a wide range of solar control strategies were investigated. DOE

N80-12587# InterTechnology Corp., Warrenton, Va.
PHOTOSYNTHESIS ENERGY FACTORY: ANALYSIS, SYNTHESIS, AND DEMONSTRATION Final Report
Nov. 1978 513 p refs
(Contract EX-76-C-01-2548)
(HCP/T3548-01) Avail: NTIS HC A22/MF A01

The potential of a combined dry-land Energy Plantation, wood-fired power plant, and algae wastewater treatment system is assessed. The cost effectiveness of recycling certain by-products and effluents from one subsystem to another is demonstrated. The algae pond provides a positive cash credit, resulting mainly from the wastewater treatment credit, which may be used to reduce the cost of the Photosynthesis Energy Factory (PEF)-generated electricity. The algae pond also produces fertilizer, which reduces the cost of the biomass produced on the Energy Plantation, and some gas. The cost of electricity is as low as 35 mills per kilowatt-hour for a typical municipally-owned PEF consisting of a 65-MWe power plant, a 144-acre algae pond, and a 33,000-acre Energy Plantation. Using only conventional or near-term technology, the most cost-effective algae pond for a PEF is the carbon-limited secondary treatment system. Analysis of the Energy Plantation subsystem at 15 sites revealed that plantations of 24,000 to 36,000 acres produce biomass at the lowest cost per ton. DOE

N80-12588# California Univ., Berkeley. Lawrence Berkeley Lab.
RESIDENTIAL ON SITE SOLAR HEATING SYSTEMS. A PROJECT EVALUATION USING THE CAPITAL ASSET PRICING MODEL M.S. Thesis
S. R. Schutz Dec. 1978 60 p refs
(Contract W-7405-eng-48)
(LBL-8298) Avail: NTIS HC A04/MF A01

The feasibility of 'on site solar heating' (OSSH) as a private utility investment was analyzed. The return on OSSH was calculated on the basis of the cost to the consumer of the equivalent amount of electrical energy that is displaced by the OSSH system. The hurdle rate for investment in OSSH was calculated using the Sharpe-Lintner Capital Asset Pricing Model. The results of this study indicate that OSSH is a low risk

investment having an appropriate hurdle rate of 7.9%. At this rate, OSSH investment appears marginally acceptable in northern California and unambiguously acceptable in southern California. The results also suggest that utility investment in OSSH should lead to a higher degree of financial leverage for utility companies without a concurrent deterioration in the risk class of utility equity. DOE

N80-12588# California Univ., Berkeley. Lawrence Berkeley Lab.
ANALYSIS OF THE CALIFORNIA SOLAR RESOURCE, VOLUME 2 Final Report
P. Berdahl, D. F. Grether, M. Martin, and M. Wanig Nov. 1978 90 p refs
(Contract W-7405-eng-48)
(LBL-7880-Vol-2) Avail: NTIS HC A05/MF A01

In order to assess the requirements for solar design data, several different paths were followed. The existing literature was consulted, analytical work was carried out within the project to determine the sensitivity of system design to errors in the solar data, and extensive contacts were made with potential users of solar data. Existing solar design techniques were evaluated in order to determine the types and quality of data needed. The determination of future solar data requirements for California was made on the basis of a regionalization of the state into solar zones, a familiarity with existing and proposed high-quality solar data networks, and knowledge of past data collection efforts. Recommendations for action by the state are presented. These recommendations are made to assure that adequate measures are taken now to meet solar data needs of the future. DOE

N80-12590# Sandia Labs., Albuquerque, N. Mex.
SOLAR MECHANICAL ENERGY STORAGE PROJECT
B. C. Caskey and H. M. Dodd 1978 6 p refs Presented at the First Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1982C; CONF-781046-10) Avail: NTIS HC A02/MF A01

Systems analyses identified flywheel energy storage systems as the most promising technology for small to intermediate load applications. Detailed design studies to investigate this storage mode are described. DOE

N80-12591# PRC Energy Analysis Co., McLean, Va.
SOLAR ENERGY COMMERCIALIZATION FOR AFRICAN COUNTRIES
Dec. 1978 101 p refs
(Contract EG-77-C-01-2522)
(HCP/CS-2522) Avail: NTIS HC A06/MF A01

Kenya, Cameroon, Nigeria, Niger, Ivory Coast, and Senegal were surveyed as part of the information acquisition task for the DOE International Solar Commercialization Working Group. All these countries are rich in solar energy and are friendly to the U.S. They represent a wide range of geographic features, climatic conditions, and energy resources. The main results are outlined. DOE

N80-12592# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEAD, NEBRASKA, 25-kW PHOTOVOLTAIC POWER SYSTEM
W. R. Romaine 5 Jan. 1979 43 p refs
(Contract EY-76-C-02-4094)
(COO-4094-10) Avail: NTIS HC A03/MF A01

In 1977 MIT/Lincoln Laboratory designed, constructed, and put into operation a 25 kW peak solar photovoltaic power system in Mead, Nebraska. This system was to be used to provide power to an agricultural test facility operated by the University of Nebraska. The initial application of the PV system was to provide power to irrigate an 80 acre cornfield. The photovoltaic power system is described as it existed at the time of its inauguration, and as it will exist following the completion of presently planned modifications, which include more fully automated control and addition of an uninterruptible power supply. DOE

N80-12593# Drexel Univ., Philadelphia, Pa.
DOUBLE-EXPOSURE COLLECTOR SYSTEM Progress Report, 1 Jul. - 30 Sep. 1978
D. C. Larson and C. W. Savery 31 Oct. 1978 11 p
(Grant EG-77-G-04-4089)
(TID-28984) Avail: NTIS HC A02/MF A01

A retrofit solar water-heating system was installed in a three-story apartment building. The system employs two conventional collector banks (10 PPG collectors) mounted at the latitude angle for Philadelphia of 40 deg from the horizontal and two double-exposure collectors (DEC's) mounted vertically in mirrored enclosures. Although the DEC units are being used for year-round domestic water heating for the building, they are designed to provide maximum output in the winter and are therefore well-suited to solar space heating applications. Instrumentation for testing the collectors was available in the apartment building. New temperature sensors and a heat exchanger were installed and regular data collection was started. Every effort is being made to assure that reliable data are being obtained. A theoretical study of alternative mirror configurations was also completed. These calculations indicate that an optimal adjustable-mirror configuration exists which is optimal at latitudes 35, 40 and 45 deg. One mirror configuration, therefore, can be employed at diverse locations and is adaptable to a variety of solar energy applications. DOE

N80-12594# Institute for Energy Analysis, Oak Ridge, Tenn.
CONSTRAINTS ON ENERGY CONSERVATION
Willem vanGool Sep. 1978 21 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-17(M)) Avail: NTIS HC A02/MF A01

Energy conservation achieved through technology is discussed and distinguished against energy conservation achieved through changes of lifestyle. In the technological approach, the objectives of energy consuming activities are not questioned; thus, it is accepted that society needs a certain amount of aluminum, polymers, transport, etc., per year. What is analyzed in this approach is how these materials and services can be provided more efficiently. Alternatively, in the change of lifestyle approach to conservation the demand as such is analyzed: do we need aluminum, can we decrease the temperature in homes, do we need to travel? The distinction between the two approaches is demonstrated by considering the rate of energy-consuming activities. R.E.S.

N80-12595# Institute for Energy Analysis, Oak Ridge, Tenn.
FUNDAMENTAL ASPECTS OF ENERGY CONSERVATION POLICY
W. VanGool Nov. 1978 39 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-20(M)) Avail: NTIS HC A03/MF A01

The 'technological fix' approach to energy conservation is discussed. Higher capital investment can lead to a decrease in direct use of energy. Both the cost and the energy involved in these investments were analyzed along a conservation path, and a limited number of constants were used to direct the changes along this path. It was found that an increase in the price of energy will lead to higher capital investments in accordance with the economic lifecycles in the different sectors. For applications with a short lifetime, such as in the transport sector, energy conservation will mainly take place through the construction of new equipment. In sectors with long-lifetime investments (e.g., buildings), retrofitting will be important. DOE

N80-12596# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL ENERGY STORAGE TECHNOLOGY DEVELOPMENT FOR ELECTRIC AND HYBRID VEHICLE APPLICATIONS
T. M. Barlow 17 Oct. 1978 10 p refs Presented at 1st Inform. Exchange Conf., Luray, Va., 24 Oct. 1978
(Contract W-7405-eng-48)
(UCRL-81786; CONF-781046-11) Avail: NTIS HC A02/MF A01

Flywheel concepts and one elastomeric energy storage concept all applicable to regenerative braking are developed. The performance and fuel economy of electric vehicles are improved. An experimental study of the effect of load leveling on battery life and analytical evaluations of mechanical energy storage technology are included. These activities are integrated in an

overall plan and management structure designed to enhance the commercialization of electric vehicles. DOE

N80-12587# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RESEARCH ON THE DYNAMICS OF BAND-SUPPORTED FLYWHEEL SYSTEMS Final Report
C. W. Bert, C. A. Kocay, T. L. Chen, and J. P. Busby Nov. 1978 61 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7074) Avail: NTIS HC A04/MF A01

Analytical research is reported relating to various aspects of the dynamics of band-supported, composite-material-rim flywheel energy-storage systems for application in hybrid automotive vehicles. A parametric study is carried out for free whirling of a flywheel system with a flywheel shaft supported by ball bearings, typical of a class of configurations contemplated in vehicular application as distinguished from R and D spin tests. It is shown that for a wide range of combinations of hub location and bearing and shaft stiffnesses, it is possible to avoid having any potentially dangerous forward-precession critical speeds throughout the desired operating range of 8,000 to 32,000 rpm. Nonlinear analyses are presented to describe the behavior of the bands in both the translational and tilting modes. The primarily softening behavior is geometrically induced and can lead to buckling at relatively small amplitudes. The band behaviors are approximated by polynomial expansions and applied to analyses of the steady-state forced whirling response. An analysis is presented for the behavior of a ring-type containment system after failure of the bands. This analysis combines Hertzian impact theory with an analysis of ring response to a concentrated load of half-sine waveform. It is shown that a 1-inch thick aramid-epoxy ring should provide satisfactory containment. Small model studies were initiated to study some of the nonlinear and containment phenomena. DOE

N80-12598# Oak Ridge National Lab., Tenn.
CRYSTALLOGRAPHIC CONTRIBUTIONS TO THE ENERGY PROBLEM
M. K. Wilkinson 1978 51 p Presented at 11th Congr. of Crystallography, Warsaw, 2 Aug. 1978
(Contract W-7405-eng-26)
(CONF-780867-1) Avail: NTIS HC A04/MF A01

Areas in which studies of crystallography can contribute to development of new materials for energy technology are reviewed. DOE

N80-12599# Oak Ridge National Lab., Tenn.
REGIONAL ECONOMIC/DEMOGRAPHIC PROJECTIONS FOR ENERGY POLICY ANALYSIS
D. J. Bjornstad Jan. 1979 37 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6668) Avail: NTIS HC A03/MF A01

The importance of adequate population and employment projections for regional policy analysis related to energy, and whether energy policy may significantly modify existing trends is studied. It is concluded that energy is less likely to create new subnational socio-economic tendencies than to enhance or retard existing trends, but that to analyze these circumstances a growth-policy format is desirable. It is emphasized that a lack of past experience with many new energy technologies will make impact analysis difficult. For this reason, attempts should be made to anticipate possible impacts well in advance of technology deployment. DOE

N80-12600# Gibbs and Cox, Inc., Washington, D. C.
OCEAN THERMAL ENERGY CONVERSION (OTEC) PLATFORM CONFIGURATION AND INTEGRATION, EXECUTIVE SUMMARY Final Report
R. J. Scott Jul. 1978 205 p refs
(Contract EG-77-C-01-4064)
(DOE/ET-4064-1) Avail: NTIS HC A09/MF A01

Studies leading to the development of conceptual designs for two 400 MW Offshore Thermal Energy Conversion (OTEC) commercial plants are summarized. A detailed overview of the study is presented. The successful deployment of a commercial OTEC plant in the near term is dependent upon the optimization of the platform configuration and power plant output level. The optimization procedure is based on both technical and economic factors and is used to evaluate a relatively large number of alternatives, i.e., six hullforms, five plant outputs ranging from 50 to 500 megawatts (MW), and three deployment sites. The hullforms under consideration include the ship (barge), cylinder (disc), spar, submersible, semi-submersible, and sphere; while the deployment sites are Hawaii, New Orleans, and Key West. The second part of the summary describes the development of the two platforms selected by DOE to be carried through the conceptual design level: a 400 MW ship and semi-submersible. DOE

N80-12601# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE. SERIAL TITLES, FEBRUARY 1976 - MARCH 1979
Mar. 1979 87 p
(DOE/TIC-4579-R10-Suppl-4) Avail: NTIS HC A05/MF A01

This supplement contains changes and additions to TID-4579-R10 (Serial titles used by the DOE Technical Information Center) and is intended for use with that publication. DOE

N80-12602# Oak Ridge National Lab., Tenn. Computer Sciences Div.
ECONOMICS OF FUSION DRIVEN SYMBIOTIC ENERGY SYSTEMS
J. P. Renier, T. J. Hoffman, and J. G. Martin 1978 7 p refs Presented at ANS Ann. Meeting, Atlanta, Ga., 3 Jun. 1979 Prepared jointly with Lowell Univ., Mass.
(Contract W-7405-eng-26)
(CONF-790602-50) Avail: NTIS HC A02/MF A01

The economic analysis of symbiotic energy systems in which U233 (to fuel advanced converters burning U233 fuel) is generated in blankets surrounding fusioning D-T plasma's depends on factors such as the plasma performance parameters, ore costs, and the relative costs of Fusion Breaders (CTR) to Advanced Fusion Converters. The analysis also depends on detailed information such as initial, final makeup fuel requirements, fuel isotopics, reprocessing and fabrication costs, reprocessing losses (1%) and delays (2 years), the cost of money, and the effect of the underutilization of the factory thermal installation at the beginning of cycle. The results are presented of calculations of overall fuel cycle and power costs, ore requirements, proliferation resistance and possibilities for grid expansion, based on detailed mass and energy flow diagrams and standard US INFCE cost data and introduction constraints, for realistic symbiotic scenarios involving CTR's (used as drivers) and denatured CANDU's (used as U233 burners). The results are compared with those obtained for other strategies involving heterogeneous LMFBR's which burn Pu to produce U233 for U233-burners such as the advanced CANDU converters (MEU233-CANDU). DOE

N80-12603# Little (Arthur D.), Inc., Cambridge, Mass.
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB) COMMERCIALIZATION REPORT. PART B: ANALYSIS OF MARKET DEVELOPMENT, VOLUME 2 Final Report
Sep. 1977 88 p
(DOE/TIC-10071) Avail: NTIS HC A05/MF A01

The SHACOB Commercialization Model is designed to gauge the impacts of selected Federal incentive programs to encourage the development of solar energy equipment for hot water heating, space heating and space cooling in residential and commercial buildings. The model was implemented as a FORTRAN program and is presently running on the FEA computer system. It is used via the super WYLBUR data management system at FEA. Some modeling results are presented. DOE

N80-12604# Stockholm Univ. (Sweden). Forskningsgruppen foer Energisystestudier.
EFFECTS OF ENERGY POLICY ON INDUSTRY
Alf Carling and Joyce Dargay Jun. 1978 211 p refs In SWEDISH; ENGLISH summary
(USFFE-1978-B) Avail: NTIS (US Sales Only) HC A10/MF A01; DOE Depository Libraries

The results from a number of studies of energy consumption in Swedish manufacturing industries and of the sensitivity of different industrial sectors to energy taxation and other kinds of energy policy measures are presented. These studies were

concentrated on three energy-intensive sectors, namely the pulp and paper industry; mining and metal production (especially iron mines and the steel industry); and the brick, cement, and lime industry. DOE

N80-12605# Los Alamos Scientific Lab., N. Mex.
PROCESS DESIGN OF THE LASL BISMUTH SULFATE THERMOCHEMICAL HYDROGEN CYCLE
K. E. Cox, J. H. Pendergrass, and W. M. Jones 1979 8 p refs Presented at Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1256; CONF-790803-25) Avail: NTIS HC A02/MF A01

A process engineering flowsheet for a design of the LASL bismuth sulfate thermochemical cycle is presented. The design is based on laboratory data that indicate a lowered endothermic heat load for a partial decomposition of the solid bismuth sulfate. The results of the flowsheeting analysis yield a thermal efficiency of 50% for the cycle when coupled to a conceptual fusion energy heat source at 1500 K. A parametric analysis shows a slight drop in efficiency as the temperature of the heat source is decreased. The LASL bismuth sulfate thermochemical cycle appears to have potential as a means of producing hydrogen from high temperature heat sources such as fusion, fission, and solar energy; it also appears to be competitive with alternative thermochemical cycles as well as with water electrolysis for hydrogen production. DOE

N80-12606# League of Women Voters, Washington, D. C.
ENERGY CONSERVATION TECHNOLOGY EDUCATION PROGRAM Final Report
Jan. 1979 106 p refs
(Contract EC-77-C-01-2165)
(HCP/M2165) Avail: NTIS HC A06/MF A01

A project on teaching the public how to use energy more efficiently in the home is described. The methodology of the project is discussed and the findings and achievements are highlighted. A.W.H.

N80-12607# Ehrenkrantz Group, New York, N. Y.
ARCHITECTURAL CONCERNS IN SOLAR SYSTEM DESIGN AND INSTALLATION
S. Weinstein Mar. 1979 34 p
(Contract EG-77-C-01-2522)
(SOLAR/0801-79-01) Avail: NTIS HC A03/MF A01

The physical (rather than the mechanical or electrical) aspects involved in the design and installation of solar systems are discussed. The typical physical factors and problems encountered in design are considered. The cost effectiveness of various approaches are analyzed. DOE's specific experience relative to what solar designers nationwide are designing in the installation of solar collectors, array structures, piping and storage equipment, with particular emphasis on cost-effective alternatives is discussed. DOE

N80-12608# Bechtel National, Inc., San Francisco, Calif.
TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR POWERED WATER PUMPING FOR REMOTE AREAS Final Report
Jul. 1979 110 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8187) Avail: NTIS HC A06/MF A01

The technology of solar powered water pumping is reviewed. An overview of the technology and its economics is provided, based on a review and assessment of the open literature. It is shown that pumped water is used most extensively for irrigation, and that new irrigation methods, such as the center pivot system, have significantly increased the water pumping power demand in recent years. The coincidence of the peak irrigation season and peak seasonal insulation makes solar energy a good candidate to supplement or displace depletable energy sources currently used for water pumping. Solar powered water pumping demonstration systems utilizing solar thermal, photovoltaic and wind powered energy conversion are evaluated. The prime movers of these systems either drive the pumps directly or indirectly through electric power generation. A comparative evaluation of these and other proposed solar concepts was conducted and resulted in the selection of a reference system comprised of a number of individual parabolic dish collectors with integral Brayton cycle engines. DOE

N80-12609# Giner, Inc., Waltham, Mass.
STUDY OF CORROSION AND ITS CONTROL IN ALUMINUM SOLAR COLLECTORS Annual Report, 1 Jun. 1977 - 31 Jul. 1978
D. Wong, F. H. Cocks, J. Giner, and P. S. Majahad Aug. 1978 68 p refs
(Contract EY-76-C-02-2934)
(COO-2934-7) Avail: NTIS HC A04/MF A01

The development of corrosion control methods for aluminum solar collectors using ethylene glycol heat transfer fluids was studied. Corrosion inhibitors and impurity scavengers were tested and evaluated at temperatures up to 160 C under various laboratory conditions. A new corrosion rate measurement technique based on the use of thin foil samples was developed and adopted in this program to provide accelerated results. In addition to the development of corrosion control methods, the acquisition of baseline corrosion data was also extended to the aluminum/propylene glycol combination. Propylene glycol was chosen primarily because of its low toxicity. Aluminum corrosion characteristics were determined in 50, 85 and 100% propylene glycol solutions at temperatures between 25 to 160 C. Corrosion behavior of aluminum in more concentrated ethylene glycol solutions (up to 100%) at higher temperatures (up to 160 C) was also obtained in order to broaden the baseline. DOE

N80-12610# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
SOLAR-POWERED STEAM GENERATOR HELIOSTAT Final Report
J. G. Cottingham Dec. 1978 143 p refs
(Contract EY-76-C-02-0016)
(BNL-50974) Avail: NTIS HC A07/MF A01

A small-size central-receiver-type solar energy collecting system delivering commerical grade steam is analyzed and a wind avoidance type heliostat designed, built, and successfully tested. The heliostat design effort is described, including reflecting surface materials and measurements, optic considerations and mirror field arrangements, mechanical analysis and fabrication techniques, and economics and cost effectiveness. measurements of normal incident solar energy at Upton, N. Y., are reported and a method is proposed for estimating this input parameter for other locations proposed. DOE

N80-12611# Ames Lab., Iowa.
PHOTOTHERMAL CONVERSION SURFACE MEASUREMENTS USING PHOTOACOUSTIC AND PHOTOTHERMAL SPECTROSCOPIES
J. F. McClelland and R. N. Kniseley 1978 31 p refs Presented at Seminar on Testing Solar Energy Mater. and Systems, Washington, D.C. 22 May 1978
(Contract W-7405-eng-82)
(IS-M-202; CONF-780550-10) Avail: NTIS HC A03/MF A01

Photoacoustic and photothermal spectroscopic techniques have recently been under development in a number of laboratories. When applied to solar materials studies these techniques have the potential of providing a more direct measurement of photothermal conversion efficiency than conventional reflection or transmission measurements. Measurements are made by modulating the intensity of an incident light beam, which causes a temperature oscillation in the irradiated material under study, with the oscillation amplitude proportional to the absorbed and subsequently thermalized light energy. In the photoacoustic method the oscillation amplitude is measured by a transducer which detects an acoustical signal driven by the temperature oscillation. A thermal transducer is used as the detector in the photothermal technique. Spectral or integrated measurements are made using a monochromatic or broadband source with no correction needed for the spectral dependence of a detector since the signal is generated by the interaction of light with the sample rather than with a detector. DOE

N80-12612# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
PHOTOTHERMAL CONVERSION OF SOLAR ENERGY INTO ELECTRICITY

Jaime A. Moragues 1978 37 p refs Transl. into ENGLISH from unidentified Argentine report
(DOE-TR-159) Avail: NTIS HC A03/MF A01

Brief description of various collectors that can be used for electricity production by solar photothermal conversion are given including solar stills, shallow solar ponds, flat plate collectors, fixed collectors with moderate concentration, cylindrical-parabolic concentrators, fixed concentrators, fixed concentrators with faceted mirror, concentrations with concave rotating multiple mirrors, Fresnel lenses, paraboloidal rotating concentrators, semispherical fixed concentrators, central receiver system with linear focus, and central receiver system with point focus. Thermodynamic cycles, energy transport, energy storage, and economics are also discussed. A review of some of the programs throughout the world in development of solar thermal power conversion is included. DOE

N80-12613# Energy Utilization Systems, Inc., Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT OF A HEAT AND PUMP WATER HEATER, VOLUME 1 Final Report
R. L. Dunning, F. R. Amthor, and E. J. Doyle Aug. 1978 69 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7321-1) Avail: NTIS HC A04/MF A01

An electric heat pump water heater with an operating efficiency of 2.5 in average conditions of 70 to 75 F ambient air and 55 to 60 F supply water was designed. Separate heat pump designs are available for new water heaters and for retrofitting of existing ones. The condenser is a dual tube direct immersion type which enters the tank through a special 4-in. hole in the top of new tanks. For retrofit units, the condenser is in the form of a helix and is screwed into the tank through the hole normally used by the lower resistance element. The payback period is dependent on the amount of hot water consumption and the price of electricity. In warm climates, the benefit/cost ratio will be improved by higher efficiency from warmer ambient air and by the value of free air conditioning and dehumidification provided while the unit is operating. In colder climates, the improved efficiency from colder supply water and the higher operating savings from higher kilowatt-hour use because of the cold water tend to offset the effect of the less favorable climate. DOE

N80-12614# Centro de Estudios de la Energia, Madrid (Spain).
PROJECT CESA-1, A 1 MW SOLAR POWER PLANT IN ALMERIA
Juan Temboury 1978 13 p Presented at Symp. on Solar Thermal Power Stations, Koeln, West Germany, 11 Apr. 1978
(AED-CONF-78-212-011; CONF-7804108-3) Avail: NTIS HC A02/MF A01

A solar energy utilization project to be carried out in Spain is described. The plant, CESA-1, is designed for a power of 1 MW. The technical data are given. The plant will start operation in 1980. DOE

N80-12615# Northeastern Legislative Leaders Energy Research Project, Albany, N. Y.
NATIONAL ENERGY ACT OF 1978: A REGIONAL ASSESSMENT
Peter R. Smith Dec. 1978 23 p
(Grant NSF ISP-75-15817)
(PB-296479/9; NSF/RA-780608) Avail: NTIS HC A02/MF A01 CSCL 10A

The detailed requirements of the National Energy Act of 1978 is presented and the specific impacts for each of the requirements on the Northeastern states is discussed. GRA

N80-12020# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIATION PRESSURE ON A UNIFORM SPHERE AS A FUNCTION OF SKIN OPTICAL PROPERTIES
Andre Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-4 Jun. 1979 p 153-163 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris) no. 1978-4, Jul.-Aug. 1978, p 209-212 Original language report was announced as A79-11137 (For primary document see N80-12013 03-01)
Avail: NTIS HC A08/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-12616 State Univ. of New York at Albany.
AN INVESTIGATION OF THE ACIDITY OF STRATUS CLOUD WATER AND ITS RELATIONSHIP TO DROPLET DISTRIBUTION, PH OF RAIN, AND WEATHER PARAMETERS Ph.D. Thesis
Raymond Adolph Castillo 1979 129 p
Avail: Univ. Microfilms Order No. 7925077

Over fifty water samples from five case studies were analyzed for pH, conductivity and ions of sodium, potassium, magnesium, calcium, ammonium, sulfate, chloride and nitrate. Trajectory analyses and CCN concentrations at 0.5 percent S confirmed that the air masses in all five cases represented relatively clean, rural, continental air. Enrichment calculations were made based on the calcium ion concentrations for sedimentary rock. Droplet spectra were determined and various mean sizes were computed from the spectra. Statistical analysis techniques were applied to relationships between cloud water and precipitation pH measurements. Simple linear regression analysis was used for ion enrichment calculations and pH versus ion concentration comparisons. Dissert. Abstr.

N80-12617 Iowa State Univ. of Science and Technology, Ames.
FIELD METHODS FOR DETERMINING NITROUS OXIDE FLUXES OVER SOIL Ph.D. Thesis
Allan Dean Matthias 1979 134 p
Avail: Univ. Microfilms Order No. 7924255

A chamber method was developed to make precise determination of rates of N2O emission from diverse soils. A cylindrical chamber is installed over the soil surface and air samples removed from the chamber are analyzed for N2O by gas chromatography. The rate of N2O emission is determined from the rate of change in the N2O concentration in the air within the chamber during the short time the chamber is over the soil surface. The chamber is relatively inexpensive, easy to fabricate, transport, and use, and can be installed without significant disturbance of the soil area under study. Studies performed to evaluate the method indicate that it is reliable and is well suited for an extensive program of research on N2O emissions from soils. Dissert. Abstr.

N80-12618 California Univ., Riverside.
STUDIES ON THE COLLECTION AND ANALYSIS OF NITRITE AND AMMONIUM IONS IN ATMOSPHERIC PARTICULATE MATTER Ph.D. Thesis
Thomas Martin Mischke 1979 128 p
Avail: Univ. Microfilms Order No. 7924298

Field experiments showed that artifact nitrate accounts for no more than 11 percent of the total nitrate in 24 hour high volume atmospheric particulate samples collected using glass fiber filters. A comparison collected of the ion specific electrode, ion chromatography, and automated colorimetric methods for analyzing ammonium ions in aqueous extracts of atmospheric particulates showed that all three methods give comparable results for ammonium. Ion chromatography and automated colorimetry give comparable results for nitrate analysis, but the nitrate specific ion electrode gives comparable results only when the method of standard addition is used. A pyrolytic nitrate and ammonium ion analyzer was constructed and shown to be comparable to colorimetric methods and capable of analyzing either aqueous extracts or filter segments. Dissert. Abstr.

N80-12619 Iowa State Univ. of Science and Technology, Ames.
A REGIONAL APPROACH TO FORECASTING ELECTRIC ENERGY REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENTS Ph.D. Thesis
Gerald Ray Hill 1979 253 p
Avail: Univ. Microfilms Order No. 7924484

A series of investigations was performed and a multistate

procedure developed for use by states in environmental reviews, in assessing the need for adding generating capacity. The multistate procedure enables states to collectively develop a regional forecast of energy requirements, while maintaining individual decision-making authority. A regional demonstration project was utilized as a means for determining what procedural problems exist in developing multistate capabilities. The demonstration project consisted of three sequential applications of the procedure to utility service areas which operate in the southeast in more than one state. Forecasts of electricity consumption were developed and information compiled on future growth of residential, commercial and industrial sectors, by state and by service area. The procedure was applied to a hypothetical midwest/southeast two-state assessment to evaluate its transferability. Performance standards were identified and acceptance criteria established for the procedure. Dissert. Abstr.

N80-12620*# Chemsoil Corp., Bakersfield, Calif.
SIMULTANEOUS STACK GAS SCRUBBING WASTEWATER PURIFICATION Final Report
[1978] 100 p
(Contract NAS9-14839)
(NASA-CR-160280) Avail: NTIS HC A05/MF A01 CSCL 13B

Variations of a process for removing sulfur dioxide from stack gases and using it to treat municipal waste water are described. The once-through system lowers the pH of the scrubbing water from minor depressions to a pH of about 2.5 under certain conditions. A recycle system uses iron for catalytic oxidation of sulfurous acid to sulfuric acid allowing very large amounts of sulfur dioxide to be absorbed in a small portion of water. The partial recycle system uses municipal wastewater and iron as a scrubbing medium, followed by neutralization of the wastewater with lime to produce an iron hydroxide precipitation which, when removed, produces tertiary quality treated wastewater. The SO2 scrubber is described, test results are analyzed, and a preliminary capital cost estimate for the three processes is included. A.R.H.

N80-12621# Committee on Commerce, Science, and Transportation (U. S. Senate).
AVIATION SAFETY AND NOISE ABATEMENT ACT OF 1979
Washington GPO 1979 32 p Rept. to accompany S. 413 for the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 29 Mar. 1979
(S-Rept-96-52) Avail: US Capitol, Senate Document Room

The hearings are reported concerning the bill to provide assistance to airport operators for preparing noise compatibility programs, and to assure aviation safety. Topics discussed include: source noise control, air traffic management, flight procedures, retrofit, and financial problems. F.O.S.

N80-12622*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MULTISPECTRAL LOOK AT OIL POLLUTION DETECTION MONITORING AND LAW ENFORCEMENT
Clarence E. Catoe and James T. McLean Oct. 1979 25 p refs
(NASA-TM-80573) Avail: NTIS HC A02/MF A01 CSCL 13B

The problems of detecting oil films on water, mapping the areal extent of slicks, measuring the slick thickness, and identifying oil types are discussed. The signature properties of oil in the ultraviolet, visible, infrared, microwave, and radar regions are analyzed. K.L.

N80-12623*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Geophysical Sciences.
THE DETERMINATION OF ATMOSPHERIC TRACE GASES USING THE CORRELATION INTERFEROMETER TECHNIQUE Final Report, period ending 31 Jan. 1979
Earl C. Kindle and Jerald T. Twitty Nov. 1979 37 p refs
(Grant NsG-1131)
(NASA-CR-162480; GSTR-79-9) Avail: NTIS HC A03/MF A01 CSCL 13B

The theoretical feasibility inherent in the correlation interferometry technique is demonstrated. High signal to noise and increased information content in a given partial interferogram are attractive features of the technique. The separation of interfering gas species is overcome by a precise measurement program for spectral line parameters of methane and other species. There are optical, mechanical, and electronic difficulties with the interferometry hardware design. Flight data from Cessna 402 over southeastern Virginia during April 1978 yielded amplitude fluctuations that are explainable only as internal nonlinearities. Misalignment of the AGC/interferometer optical axis also contributed to a large error source in the flight data. It is concluded that no useful data on gas burdens was obtained from these flights. K.L.

N80-12624# Gulf Universities Research Consortium, Bellaire, Tex.
NATURALLY OCCURING CARBON DIOXIDE SOURCES IN THE UNITED STATES. A GEOLOGIC APPRAISAL AND ECONOMIC SENSITIVITY STUDY OF DRILLING AND PRODUCING CARBON DIOXIDE FOR USE IN ENHANCED OIL RECOVERY
F. W. Zimmerman and C. W. Perry May 1979 137 p refs
(Contract EX-76-C-01-2025)
(FE-2025-38; GURC-Rept-165) Avail: NTIS HC A07/MF A01

Preliminary characterizations of reservoir rock quality and gas composition were performed for central Mississippi, West Virginia, the Delaware-Val Verde Basins of west Texas, and several locations in the Rocky Mountains. Four significant accumulations of carbon dioxide were chosen for in-depth geologic, reservoir, and economic analyses. Anticipated flowing pressure, sustained flow rates, recovery efficiencies, original gas in place, and reserves were determined. Sensitivity studies designed to bracket a possible range of prices were generated, utilizing estimated development and production costs, for each of the four areas. Projections of the potential supply, profitability of drilling and producing, and preliminary analysis of potential demand for naturally occurring carbon dioxide are presented. DOE

N80-12625# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL MODELING OF LNG SPILL PHENOMENA
W. J. Hogan, B. R. Bowman, and L. C. Haselman 13 Dec. 1978 18 p refs Presented at the Seminar on LNG Peak Shaving, Washington, D. C., 5 Mar. 1978
(Contract W-7405-eng-48)
(UCRL-82031; CONF-780387-1) Avail: NTIS HC A02/MF A01

The phenomena that must be simulated in modeling postulated liquefied natural gas (LNG) spills are complex, and some are not thoroughly understood. These phenomena include differential boil-off, flameless vapor explosions, vapor dispersion, and various modes of combustion. Our modeling results indicate that differential boil-off will create an ethane-enriched portion of the vapor cloud and that this portion will persist for significant times. Dispersion-model predictions begin to disagree at spill sizes between 50 and 100 cu m. Thus, spill tests are needed for larger spills. Both simple and complex combustion models exist. However, uncertainties in the combustion efficiency, optical thickness of the fireball, and cooling effects make the results of these models difficult to interpret properly. They do show that the addition of as little as 5% ethane to a methane cloud would increase the detonability of the cloud eightfold. The state of numerical modeling for evaluating postulated LNG accidents indicates that the theoretical and experimental efforts must be carried out interactively. DOE

N80-12626# Oregon State Univ., Corvallis. Dept. of Air Resources.
ESTIMATES FOR WET AND DRY REMOVALS CONTRIBUTION TO THE RESIDENCE TIME FOR ATMOSPHERIC POLLUTANTS IN THE EASTERN UNITED STATES
D. Vickers and W. G. N. Slinn Apr. 1979 85 p refs
(Contract EY-77-S-09-0980)
(SR-0980-6) Avail: NTIS HC A05/MF A01

The length of time that atmospheric pollutants released from low level sources in the midwestern United States remain in the atmosphere is discussed. Layer-average trajectories originating from Kansas City, Missouri are used to determine Lagrangian probability of dry and wet conditions. In summer,

the probability that precipitation is experienced by the pollutant is twice as great as the probability of precipitation at the origin of pollution; this ratio of probabilities is three in winter. Therefore, when precipitation scavenging is the more important removal mechanism, statistics for length of wet and dry periods at the source region overestimate residence time by a factor of about two to three. By taking into consideration Lagrangian probability of wet and dry periods, the relative importance of dry deposition and precipitation scavenging is discussed as a function of the wet and dry removal rates. Estimates for the expected atmospheric lifetimes of aerosol particles and trace gases are reported as functions of dry deposition velocities and collection efficiencies. DOE

N80-12627# California Univ., Livermore. Lawrence Livermore Lab.
ATMAS: A THREE-DIMENSIONAL ATMOSPHERIC TRANSPORT MODEL TO TREAT MULTIPLE AREA SOURCES
D. L. Ermak, R. A. Nyholm, and R. Lange 27 Nov. 1978 23 p refs
(Contract W-7405-eng-48)
(UCRL-52603) Avail: NTIS HC A02/MF A01

An atmospheric transport computer model which estimates the concentration of gaseous species emitted from multiple area sources is presented. It can handle space- and time-varying wind fields, first-order chemical transformations, ground deposition, and inversion effects. The model is based on the three-dimensional advection-diffusion equation to describe atmospheric transport. The model calculates short term (hourly) average concentrations over periods ranging from a month to a year; it can also calculate longer averages by varying the averaging time. A demonstration of the model is presented along with the output of the computer code. Output from the code typically includes isopleth maps showing the calculated concentration levels and the probability with which given thresholds or standards are exceeded during the simulation period. DOE

N80-12628# California Univ., Livermore. Lawrence Livermore Lab. Energy and Resources Group.
ENVIRONMENTAL ASPECTS OF ALTERNATIVE ENERGY TECHNOLOGIES FOR CALIFORNIA
J. P. Holdren, G. Morris, and G. Tanenbaum Nov. 1978 167 p refs
(Contract W-7405-eng-48)
(UCRL-15002) Avail: NTIS HC A08/MF A01

The following topics are discussed: (1) cost benefit analysis of energy impacts on biological, geophysical, and social environments; (2) impacts of soft and transition technologies such as solar heat, onsite/central wind systems, waste/farm biomass systems, geothermal heat/electricity, hydroelectric dams, and fluidized bed coal burners; (3) observations on increased efficiency; and (4) needs for further work. DOE

N80-12629# AD-EX, Portola Valley, Calif.
MEASUREMENTS OF INDOOR AIR CONDITIONED ENVIRONMENTS AND PRACTICAL EVALUATIONS OF INTAKE OF ATMOSPHERIC AIR. PART 4: COMPARISON OF MEASUREMENT RESULTS AND SIMULATION RESULTS. PART 5: STUDIES OF SIMULATION METHODS FOR OPTIMAL DESIGN OF AIR-CONDITIONED ENVIRONMENTS.
Nobuo Nakahara, Tatsu Goto, Yusuke Nakajima, and Keiji Kubo Apr. 1979 26 p refs Transl. into ENGLISH of Conf. paper from Ohbayashi-Gumi, Equipment Design Dept., Japan 26 p Presented at Sci. Lecture Meeting of Soc. of Heating, Air-Conditioning and Sanitary Engr. of Japan, Fukuoka, 20-21 Oct. 1978 Sponsored by DOE Prepared for Calif. Univ., Lawrence Berkeley Lab.
(UCRL-Trans-1570-Pt-4/5; Conf-7810174-1-Pt-4/5) Avail: NTIS HC A03/MF A01

The results of macroscopic simulation are compared to the results of actual measurements of the CO2 concentration in a system in which the CO2 concentration inside the main returning air duct is made to stand for the indoor CO2 concentration in the entire building. The results showed rather good agreement between the measurement results and the simulation results. Evaluations in terms of the dynamic contamination concentrations were made using a computer for a general model building. The CO2 and dust were considered with reference to the air conditioning systems and the amounts of intake of atmospheric air. Cases where there were rather high rates of occupancy of offices were evaluated, and the results were used for judging the dynamic effects. DOE

N80-12630# Brookhaven National Lab., Upton, N. Y.
SOME POTENTIAL EFFECTS OF ACID RAIN ON FOREST ECOSYSTEMS: IMPLICATIONS OF A COMPUTER SIMULATION
D. B. Botkin (Marine Biol. Lab., Woods Hole, Mass.) and J. D. Aber (Marine Biol. Lab., Woods Hole, Mass.) Apr. 1979 16 p refs
(Contract EY-76-C-02-0016)
(BNL-50889) Avail: NTIS HC A02/MF A01

Potential effects of acid precipitation on forest productivity and species composition were considered through the use of the JABOWA forest growth simulator. Physiological studies suggest that current levels of acid rain would result in a mortality of 5.5% or less of tree leaf tissue, depending on the species. Such reductions produce nonsignificant changes in the total productivity of the simulated forest. Significant changes in total productivity and relative species composition do occur at much higher levels of effects and are discussed. The simulations reported consider only effects due to species interactions and direct impact on leaves; no changes on soil chemistry are assumed. DOE

N80-12631# Argonne National Lab., Ill.
COMBINED EFFECTS OF POLYCYCLIC AROMATIC HYDROCARBONS AND SUNLIGHT
H. Utsumi, G. R. Lakas, and M. M. Elkind 1979 15 p refs Presented at Park City Environ. Health Conf., Utah, 4-7 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790447-4) Avail: NTIS HC A02/MF A01

Chinese hamster V79 cells were made photosensitive by dimethylbenzanthracene (DMBA) if the cells were treated with this PAH before, and not after, light exposure at wavelengths from approximately 290 to 400 nm. Samples of PAH's generated from a bench-scale pressurized fluidized bed coal combustion unit sensitized mammalian cells to sunlight-simulating light, although to a lesser extent than the DMBA. In addition, the photosensitization was shown to be a true photodynamic effect. Since all three factors (PAH's sunlight, and oxygen) necessary for the production of the phototoxic agent(s) would be expected to interact in the environment, the results are of particular concern to human health. Both PAH's and sunlight are known carcinogens and their interaction may result in a potentiation of their carcinogenic activities. In addition, the cytotoxicity produced could conceivably have a tumor promoting effect due to the resultant cellular repopulation. DOE

N80-12632# Oak Ridge National Lab., Tenn.
WHAT ROLE CAN SIMULATION MODEL PREDICTIONS PLAY IN ENVIRONMENTAL DECISIONS: CARBON DIOXIDE AS AN EXAMPLE
W. R. Emanuel 1979 10 p refs Presented at Inst. of Ecology Workshop, Indianapolis, 8 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790468-1) Avail: NTIS HC A02/MF A01

Various models of the global carbon cycle constructed to predict levels of CO2 in the atmosphere as a result of man's activities are described. The progression of models developed to analyze the global carbon cycle in resolving the CO2/climate issue indicates the changing character of models depending on the immediate role they play in environmental decision making. The dominant and successful role served by models in the carbon cycle problem points to the desirability of this flexible approach. DOE

N80-12633# Environmental Sciences Research Lab., Research Triangle Park, N.C. Atmospheric Chemistry and Physics Div.
OPTIMIZED CHEMILUMINESCENCE SYSTEM FOR MEASURING ATMOSPHERIC AMMONIA
Ralph Baumgardner, W. A. McClenny, and R. K. Stevens Feb. 1979 48 p refs
(PB-298248/6; EPA-600/2-79-028) Avail: NTIS

HC A03/MF A01 CSCL 14B

The optimization and testing of a continuous measurement system for analyzing atmospheric ammonia concentrations is described. The measurement system combines an ultra sensitive chemiluminescence detector, with a thermal converter for NH3 to NO conversion, and an acidic scrubber for alternate removal of NH3 from the sample stream. The chemiluminescence monitor with a high temperature converter gives a combined measurement of NO, NO2, and NH3. By taking the signal difference when the scrubber is in or out of the sample line, the concentration of NH3 is determined. Performance tests were conducted on the total measurement systems to verify its capability to measure NO, NO2, and NH3 under laboratory conditions and ambient monitoring conditions. GRA

N80-12634# North Carolina State Univ. at Raleigh. Water Resources Research Inst.

ASSESSING MAN'S IMPACT ON WETLANDS

G. E. Galloway (Military Academy) Dec. 1978 116 p refs Sponsored by NOAA

(PB-298736/0; UNC-SG-78-17; NOAA-79070910) Avail: NTIS HC A06/MF A01 CSCL 13B

The characteristics of a usable system for assessing man's impact on wetlands are defined and evaluation techniques are surveyed. A wetland evaluation system is proposed and applied to case studies of wetland evalution in the Yazoo Basin of Mississippi and the Neuse River Estuary of North Carolina. GRA

N80-12635# Pennsylvania State Univ., University Park. Center for the Study of Science Policy.

AIRCRAFT NOISE AND THE MARKET FOR RESIDENTIAL HOUSING: EMPIRICAL RESULTS FOR SEVEN SELECTED AIRPORTS Final Report, Jul. 1977 - Sep. 1978

Jon P. Nelson Sep. 1978 153 p

(Contract DOT-OS-70066)

(PB-297681/9; DOT/RSPA/DPB-50/78/24) Avail: NTIS HC A08/MF A01 CSCL 05C

The effect on property values of a decibel change in noise exposure forecast levels is studied. Census block and census tract data are employed for small geographic areas (about two miles radius) near seven selected major U.S. airports. In each of seven cases, the results indicate that aircraft noise has a negative and statistically significant effect on residential property values. GRA

N80-12636# Central Research and Design Inst. for Open-pit Mining, Wroclaw (Poland).

PURIFICATION OF WATERS DISCHARGED FROM POLISH LIGNITE MINES

Henryk Janiak Apr. 1979 178 p refs

(Contract EPA-05-534-3)

(PB-297466/5; EPA-600/7-79-099) Avail: NTIS HC A09/MF A01 CSCL 08I

Studies were conducted using flocculants to improve sedimentation basin efficiency. The dependence of purification on the length of fast mixing, flocculant dose rates, and concentration of solutions employed were evaluated. The laboratory results were verified in a pilot scale sedimentation basin. Studies of the hydraulics of the sedimentation basin and investigations of flocculant application are discussed. The relationships between the dose of flocculant and time of retention and the reduction of suspended solids, turbidity, oxygen demand and other chemical parameters were made. Results of pilot tests confirmed the usability of cationic polyelectrolites in purification of mine waters. GRA

N80-12637# TRW, Inc., Redondo Beach, Calif.

EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 1: GAS- AND OIL-FIRED RESIDENTIAL HEATING SOURCES Final Report, Sep. 1976 - Mar. 1979

N. F. Surprenant, R. R. Hall, K. T. McGregor, and A. S. Werner May 1979 177 p refs

(Contract EPA-68-02-2197)

(PB-298494/6; EPA-600/7-79-029B) Avail: NTIS HC A09/MF A01 CSCL 13B

Emissions from gas- and oil-fired residential heating sources were assessed through a critical examination of existing emissions data, followed by the conduct of a phased measurement program to fill gaps in the emissions data base. Mass emission rates of criteria pollutants, trace elements, and organics, including polycyclic organic matter (POM), were determined. Particulate sulfate, SO2, and SO3 emission data were also obtained at the oil-fired sites. The results of the emissions assessment indicate that residential sources are of potential significance based on multiple source severity factors calculated for an array of houses burning gas or oil. Pollutants for which multiple source severity factors exceed 0.05 are NOx from gas-fired sources and SO3, and NOx, and Ni from oil-fired sources. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-12638 California Univ., Santa Cruz.

DEFORMATION MECHANISMS IN THE OLIVINE AND SPINEL PHASES OF MAGNESIUM GERMANATE AND APPLICATIONS TO THE EARTH'S MANTLE Ph.D. Thesis

Peter James Vaughan 1979 345 p

Avail: Univ. Microfilms Order No. 7924598

An experimental study of the high temperature creep properties of the olivine and spinel phases of Mg2GeO4 is described. The fractional increase in the elastic velocities due to the olivine-spinel transition in the germanate was found to be approximately the same as that for a similar transition in the silicate. Dissert. Abstr.

N80-12639 Saint Louis Univ., Mo.

A THEORETICAL TREATMENT OF HYDROMAGNETIC DISTURBANCES GENERATED IN THE OUTER MAGNETOSPHERE BY DISCRETE SOLAR EMISSIONS Ph.D. Thesis

James Lee Hickerson 1979 143 p

Avail: Univ. Microfilms Order No. 7923648

A semi-quantitative demonstration to prove that simple models of the solar wind interaction with the earth's outer magnetic field and plasma can produce the observed perturbations is presented. The basic linearized magnetofluidynamic equations are modified to relate the influence of disturbance sources. Employing a tensorial representation of Fourier transformations of the basic differential equations, a pair of coupled equations called the master set, are determined. A demonstration of the capability of the formulation to produce acceptable results is presented. The use of less idealistic formulations of the source characteristics with the expectation of producing convergent inversions and formulating the analysis from the beginning so that a fast Fourier transform computer algorithm may be utilized is suggested. Dissert. Abstr.

N80-12640 Iowa Univ., Iowa City.

INTENSE ELECTROSTATIC WAVES NEAR THE UPPER HYBRID RESONANCE FREQUENCY Ph.D. Thesis

William Steven Kurth 1979 155 p

Avail: Univ. Microfilms Order No. 7924494

Plasma wave measurements, using instruments on the IMP 6 and Hawkeye 1 satellites, are utilized in a study of very intense electrostatic waves near the upper hybrid resonance frequency in the region just outside the plasmapause. These intense plasma wave events have electric field strengths of approximately 1 to 20 mV/m and are among the most intense waves seen in the earth's magnetosphere. Detailed studies of more than 140 of these intense electrostatic disturbances reveal that the events occur at all local times and at magnetic latitudes varying from the equator to as high as 50 deg. The polarization of these waves is such that the wave electric field vector is oriented perpendicular to the geomagnetic field. In most cases the center frequency of he intense waves appears to correspond to an (n + 1/2)f(-) sub g harmonic near the upper hybrid resonance frequency. The implications of the presence of the intense upper hybrid resonance waves on plasmas in the magnetosphere are discussed. In addition, the presence of large electrostatic waves

may be related to the terrestrial radio spectrum. Evidence is presented which suggests the intense electrostatic waves may be a source of non-thermal continuum radiation. Dissert. Abstr.

N80-12641 Montana Univ., Missoula.
GRAVITATIONAL AND ELECTROMAGNETIC POTENTIALS OF THE STATIONARY EINSTEIN-MAXWELL FIELD EQUATIONS Ph.D. Thesis
Thaddeus Charles Jones 1979 188 p
Avail: Univ. Microfilms Order No. 7925068

Associated with the stationary Einstein-Maxwell field equations is an infinite hierarchy of potentials. The basic characteristics of these potentials are examined in general and then in greater detail for the particular case of the Reissner-Nordstrom metric. Their essential utility in the process of solution generation is elucidated and the necessary equations for solution generation are developed. Appropriate generating functions, which contain the complete infinite hierarchy of potentials, are developed and analyzed. Particular attention is paid to the inherent gauge freedom of these generating functions. Two methods of solution generation, which yield asymptotically flat solutions in vacuum, are generalized to include electromagnetism. One method, using potentials consistent with the Harrison transformation and the Reissner-Nordstrom metric, is discussed in detail and its resultant difficulties explored. Dissert. Abstr.

N80-12642*# National Aeronautics and Space Administration. Pasadena Office, Calif.
GEOLOGICAL ASSESSMENT PROBE Patent Application
Earl R. Collins, inventor (to NASA) (JPL) Filed 25 Sep. 1978 16 p Sponsored by NASA
(NASA-Case-NPO-14558-1; US-Patent-Appl-SN-945436) Avail: NTIS HC A02/MF A01 CSCL 08G

A probe is described which can be installed in a side hole that extends from a bore hole in the earth, to assess the permeability of the strata surrounding the borehole. The probe is elongated and has seals spaced the walls of the side hole to form chambers sealed from one another. A tracer fluid injector on the probe can inject a tracer fluid into one of the chambers, while a tracer fluid detector located in another chamber can detect the tracer fluid, to thereby sense the permeability of the strata surrounding the side hole. The probe can include a train of modules, with each module having an inflatable packer which is inflated by the difference between the borehole pressure and the strata pressure. NASA

N80-12643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFORMATION THEORY AND THE EARTH'S DENSITY DISTRIBUTION
David Parry Rubincam Aug. 1979 43 p refs Revised Submitted for publication
(NASA-TM-80586) Avail: NTIS HC A03/MF A01 CSCL 08G

An argument for using the information theory approach as an inference technique in solid earth geophysics. A spherically symmetric density distribution is derived as an example of the method. A simple model of the earth plus knowledge of its mass and moment of inertia lead to a density distribution which was surprisingly close to the optimum distribution. Future directions for the information theory approach in solid earth geophysics as well as its strengths and weaknesses are discussed. R.E.S.

N80-12644*# California Inst. of Tech., Pasadena. Seismological Lab.
A GLOBAL GEOCHEMICAL MODEL FOR THE EVOLUTION OF THE MANTLE
Don L. Anderson [1979] 44 p refs
(Grant NsG-7610)
(NASA-CR-162602; CONTRIB-3296) Avail: NTIS HC A03/MF A01 CSCL 08G

It is proposed that the upper mantle transition region, 220 to 670 km, is composed of eclogite which has been derived from primitive mantle by about 20 percent partial melting and that this is the source and sink of oceanic crust. The remainder of the upper mantle is garnet peridotite which is the source of continental basalts and hotspot magmas. This region is enriched in incompatible elements by hydrous and CO2 rich metasomatic fluids which have depleted the underlying layers in the L.I.L. elements and L.R.E.E. The volatiles make this a low-velocity, high attenuation, low viscosity region. The eclogite layer is internally heated and its controls the convection pattern in the upper mantle. Plate tectonics is intermittent. The continental thermal anomaly at a depth of 150-220 km triggers kimberlite and carbonatite activity, alkali and flood basalt volcanism, vertical tectonics and continental breakup. Hot spots remain active after the continents leave and build the oceanic islands. Mantle plumes rise from a depth of about 220 km. Midocean ridge basalts rise from the depleted layer below this depth. Material from this layer can also be displaced upwards by subducted oceanic lithosphere to form back-arc basins. F.O.S.

N80-12645# Scripps Institution of Oceanography, La Jolla, Calif. Visibility Lab.
AIRBORN MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES, SUMMARY AND REVIEW 3 Final Report, 1 Aug. 1975 - 30 Sep. 1978
Seibert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Dec. 1978 119 p refs
(Contract F19628-76-C-0004; AF Proj. 7621)
(AD-A073121; SIO-Ref-79-5; AFGL-TR-78-0286) Avail: NTIS HC A06/MF A01 CSCL 04/1

This report summarizes a three year period devoted primarily to collection and evaluation of optical atmospheric data describing the western European environment. Five field expeditions were made between April 1976 and September 1978. They were conducted as a cooperative, but independent effort associated with the NATO Research Study Group 8 of Panel IV, AC243 and their Program OPAQUE. Measurements were made in six representative geographical areas during each of the four seasons, Summer, Fall, Winter and Spring. Optical measurements were made in four regions within the visual spectrum as follows: two moderately narrow bands having mean wavelengths of 478 and 664 nanometers, one slightly wider band at 765 nanometers and one relatively broad band representing the photopic response having a mean wavelength of 557 nanometers. The daytime optical measurements included total volume scattering coefficient, sky and terrain radiances, and both upwelling and downwelling irradiances. Simultaneous meteorological measurements included temperature, dewpoint temperature and atmospheric pressure. The optical atmospheric properties derived from these data and presented in reports typified by AFGL-TR-76-0188 and AFGL-TR-78-0168 are reviewed as are their methods of derivation and validation. The methods of data collection and processing are summarized and reviewed as is the overall resulting data bank. Examples related to the use of the data are included as well as recommendations for further data study and interpretation. GRA

N80-12646# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
TWO-BODY POSITIVE ION-NEGATIVE NEUTRALIZATION Final Report, 19 Oct. 1974 - 31 Dec. 1978
T. M. Miller, A. P. Hickman, F. T. Smith, and J. R. Peterson 30 Jan. 1979 76 p refs
(Contract F19628-75-C-0050)
(AD-A073145; SRI-MP-79-010; AFGL-TR-79-0039) Avail: NTIS HC A06/MF A01 CSCL 04/1

The results are presented of a combined experimental and theoretical investigation of ion-ion mutual neutralization processes relevant to the earth's ionosphere. Experimetal results from our merged beams apparatus (thermal rate coefficients reduced from cross sections for nineteen sets of reactants) and also those from the more recent Birmingham experiments using a flowing afterglow are reviewed. The advantages and disadvantages of both techniques are discussed. A discrepancy in the NO(-) - NO(-)3 results is attributed to an effect of excitation in the NO-3 beams of the merged beams, and it is concluded that because of these effects the flowing afterglow is presently better for obtaining rate coefficients for complex molecular ions. Our theoretical work has focused on two neutralization mechanisms: electron transfer and tidal distortion. A new formulation of the collision dynamics, Semiclassical Perturbation Scattering Theory, was developed and used to estimate the importance of the tidal distortion mechanism. It is concluded that the electron transfer mechanism dominates in reactions of simple ions and small

clusters, but that the tidal distortion becomes more important for multiply hydrated reactants. An approximate scaling formula for the rate constants is obtained that fits a wide range of experimental data involving simple ions and small clusters with an accuracy of about + or - 30%. GRA

N80-12647# California Univ., Berkeley. Lawrence Berkeley Lab.
CIRCUMSOLAR RADIATION DATA FOR CENTRAL RECEIVER SIMULATION
A. Hunt, D. Grether, and M. Wahlig Aug. 1978 14 p ref Presented at ERDA Workshop on Methods for Optical Analysis of Central Receiver Systems, Houston, Tex., 10 Aug. 1978
(Contract W-7405-eng-48)
(LBL-8371; CONF-780885-1) Avail: NTIS HC A02/MF A01

The circumsolar measurement project carried out to provide data to assess the effects of circumsolar radiation on the operation of solar thermal conversion systems using concentrating collectors, especially central receiver systems is described. Four circumsolar telescopes were constructed and are providing detailed intensity vs. angle profiles of the solar and circumsolar region, as well as other solar and climatological data. Emphasis is on reducing the data and making it available to groups analyzing the performance of central receiver systems. In most highly concentrating solar systems, the size of the receiver is determined by the ray bundle originating from the most distant heliostat. If the bundle size is calculated by using the solar disc, it is clear that some fraction of the circumsolar radiation will fall outside the receiver aperture. The results provide the detailed type of input data for central receiver simulation codes that are necessary for determining these losses, optimizing the receiver or field size, and determining the distribution of stray flux due to circumsolar radiation. DOE

N80-12648# California Univ., Berkeley. Lawrence Berkeley Lab.
ANALYSIS OF MEASURED VALUES FOR THE STATE OF STRESS IN THE EARTH'S CRUST
D. B. Jamison and N. G. W. Cook Aug. 1978 17 p refs
(Contract W-7405-eng-48)
(LBL-7071) Avail: NTIS HC A02/MF A01

Fifty stress measurements of the earth's crust which have yielded the complete state of stress and in which one of the principal stresses is vertical, were selected for a statistical analysis in an endeavor to define the nature of the state of stress in the crust. The data were analyzed as a whole, and divided into three groups depending upon whether the vertical stress was the maximum, minimum or intermediate principal stress. Linear regression analyses of the values of half the maximum stress difference as a function of half the sum of the maximum and minimum principal stresses were made. The correlation coefficients for these fits were 0.786 for the data as a whole and 0.848, 0.790 and 0.383 for each of the groups. Values of the coefficient of sliding friction between blocks of rock comprising the crust, interpreted from the slopes of these lines, ranged from 0.625 (for maximum principal stress) through 0.427 (for minimum principal stress), to 0.220 (for intermediate principal stress). DOE

N80-12649# Sandia Labs., Albuquerque, N. Mex.
SEISMIC ACTIVITY GENERATED BY HYDRAULIC FRACTURING
C. L. Schuster and R. W. Seavey 1978 12 p refs Presented at the ASME Energy Technol. Conf., Houston, Tex., 5 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0072; CONF-781112-4) Avail: NTIS HC A02/MF A01

A hydraulic fracture experiment was conducted at the Nevada Test Site. The formation to be fractured was located adjacent to a tunnel complex that allowed for the installation of a seismic array. Seismic recordings were made during the entire pumping of 214 barrels of water and cement slurry. More than a hundred separate seismic signals were received interspersed throughout the entire pumping period. Analysis of the arrival times and time delays between the P and S waves allowed the fracture location to be mapped. This location was verified during the mineback phase of the experiment. Analysis of the seismic data revealed that, to a large extent, the signals received were caused by shear type displacements. The source of these signals was apparently caused by natural fractures that were cut by the driven hydraulic fracture and then later had a fault slip type of motion. DOE

N80-12650# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE OF THE EARTH'S CRUST AND UPPER MANTLE PLOTTED FROM DATA OF SEISMIC STUDIES
V. B. Sollogub, ed. and A. V. Chekunov, ed. 1977 601 p refs Transl. into ENGLISH of the book "Stroenie Zemnoi Kory i Verkhnei Mantii po Dannym Seismicheskikh Issledovanii", Kiev, Naukova Dumka, 1977 308 p Sponsored by DOE
(UCRL-Trans-11392) Avail: NTIS HC A99/MF A01

The reports of the International conference on the deep crustal investigations by seismic methods (Kiev, October 1974) are presented. The results of geophysical investigations made in Europe and Asia are given. Some aspects of wave fields theory in layered and inhomogeneous media as well as the questions of technique and interpretation of the seismological and DSS data are considered. DOE

N80-12651# California Univ., Livermore. Lawrence Livermore Lab.
PREDICTIONS OF THE EFFECTS ON THE STRATOSPHERE OF CHANGES IN THE OXIDES OF NITROGEN
W. H. Duewer and D. J. Wuebbles Mar. 1979 20 p refs Presented at NASA Stratospheric Workshop, Harper's Ferry, W.Va., 4 Jun. 1979
(Contract W-7405-eng-48)
(UCRL-82553; CONF-790607-2) Avail: NTIS HC A02/MF A01

Predictions of the influence of changes in the oxides of nitrogen on stratospheric ozone are presented. Some of the most important aspects of the chemistry of the oxides of nitrogen in the stratosphere are examined and some of the natural and anthropogenic sources of oxides of nitrogen that were proposed will be evaluated. The more recent estimates of the effects of these sources on stratospheric composition are summarized. DOE

N80-12652# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
ROUTINE SPECTRAL MEASUREMENTS OF INFRARED RADIATION FROM THE ATMOSPHERE
Paul Berdahl Mar. 1979 8 p ref Presented at Intern. Conf. on Infrared Phys., Zurich, 5 Mar. 1979
(Contract W-7405-eng-48)
(LBL-8777; CONF-790355-1) Avail: NTIS HC A02/MF A01

A quantitative knowledge of the infrared radiative transfer between the atmosphere and a building's surface requires detailed information regarding the angular and spectral distribution of the radiation from the atmosphere. The filter spectrometer system described is intended to provided data records at 30 minute intervals for weeks and months of continuous operation. The spectrometer design incorporates a Barnes Corporation model 12-880 radiometer equipped with an eight-position filter wheel, germanium lens, and pyroelectric detector. DOE

N80-12653# National Oceanic and Atmospheric Administration, Boulder, Colo. National Geophysical and Solar-Terrestrial Data Center.
ANNUAL MEAN VALUES OF GEOMAGNETIC COMPONENTS FOR SELECTED OBSERVATORIES, 1940 - 1973
Takesi Yukutake (Tokyo Univ.), William I. Paddock, and Joe H. Allen Jun. 1979 87 p
(PB-298716/2; NOAA-79062001; SE-17) Avail: NTIS HC A05/MF A01 CSCL 08N

Annual mean values of the geomagnetic components obtained at observatories were made based on data collected at the World Data Center A (WDCA) for 1940-73. This collection is based primarily on all-day means obtained by direct communication with the observatories or taken from year books. A table includes the names and abbreviations of the observatories, their geographic coordinates, and periods of operation. For those observatories that changed their sites during the interval 1940-73, locations and operation periods are also given. Individual data lists show uncorrected (original) and corrected annual means for each

station. The corrected component annual mean values are plotted on the diagrams following the individual data lists. DOE

N80-12654# Chicago Univ., Ill. Cloud Physics Lab.
THE ROLE OF COALESCENCE NUCLEI IN WARM RAIN INITIATION
David B. Johnson Mar. 1979 138 p refs
(Grants NSF-GI-33373; NSF-ENV72-03399; NSF ATM-77-08970; NSF ATM-77-12454; NSF ATM-18-18459) (PB-298556/2; UCHI-CPL-79-55) Avail: NTIS HC A07/MF A01 CSCL 04A

The role of giant and ultragiant aerosol particles in the initiation of rain by the coalescence of cloud droplets is investigated. The aerosol particles involved in this process are so large that they can start to grow effectively by coalescence with smaller cloud droplets without prior growth by condensation. GRA

N80-12655# Geological Survey, Lawrence, Kans. Water Resources Div.
GUIDELINES FOR THE USE OF STRUCTURAL VERSUS REGRESSION ANALYSIS IN GEOMORPHIC STUDIES Final Report
W. R. Osterkamp, J. M. McNellis, and P. R. Jordan Nov. 1978 27 p refs
(PB-298360/9; USGS/WRD/WRI-79/024; USGS/WRI-78-135) Avail: NTIS HC A03/MF A01 CSCL 08G

The practical application of simple structural analysis of water resources is discussed. Guidelines are presented to aid in the selection of a proper curve-fitting technique for relating two or more variables. An easily applied method to convert a regression relation to a structural relation is also presented. R.E.S.

N80-12042# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC DENSITY, TEMPERATURE AND PRESSURE PROFILES FOR WINTER ANOMALOUS CONDITIONS AT HEIGHTS BETWEEN 52 AND 117 KM
Demetrius G. Papanikas, Jochen Baete, Manfred Becker, and Uwe Niederloehner *In its* Contrib. to Gas Dyn. and Aerodyn. Jun. 1979 p 128-167 refs Transl. into ENGLISH from 'Ermittlung der atmosphaerischen Dichter-, Temperatur- und Druckverteilungen bei winteranomalen zustaenden in Hoehen zwischen 52 and 117 km', DFVLR, Cologne Report DLR-FB-77-36, Jul. 1977 (For primary document see N80-12035 03-01)
Avail: NTIS HC A15/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-12656 New York Univ., N. Y.
A NEW SYSTEM OF EQUATIONS FOR NUMERICAL WEATHER FORECASTING Ph.D. Thesis
Gerald Lee Browning 1979 83 p
Avail: Univ. Microfilms Order No. 7925446

Kreiss has recently developed a general theory for the initialization of symmetric hyperbolic systems with multiple time scales. Using the theory, initiolization schemes are obtained for two systems of equations. The first system is the standard shallow water system with orographic effects taken into account. For this system it is shown that previous initialization schemes are just special cases of the new theory. The second system is a new system which is derived from the Eulerian equations by a proper mathematical limiting procedure. As a proper limit of a symmetric hyperbolic system, the new system retains the well-posedness features of the Eulerian equations and, therefore, is necessarily not the primitive equation system. The new system admits nonhydrostatic solutions while precluding both horizontal and vertical sound waves. It may be used for both large-scale and mesoscale modeling. The effectiveness of the initialization schemes is demonstrated by using the data obtained from them in numerical models. Dissert. Abstr.

N80-12657 Oklahoma Univ., Norman.
DYNAMIC BEHAVIOR OF SINGLE AND MULTIPLE VORTEX TORNADOES INFERRED FROM LABORATORY SIMULATION Ph.D. Thesis
Fred Weldon Leslie 1979 154 p
Avail: Univ. Microfilms Order No. 7926012

A vortex generator was used to simulate tornado flows in the laboratory. Geometric and dynamic similitude was maintained to insure that the laboratory flow models the environment of natural tornadoes. The very small pressure drops were measured with a sensitive pressure transducer while the mean flow and the turbulent fluctuations were measured with a hot film anemometer. The influence of a rough surface on the vortex core and the multiple vortex transition phenomenon were also investigated. The results indicate that the core radius over a given surface is determined predominantly by the swirl ratio parameter. When a lower rough surface is placed in the apparatus, the core radius decreases. The increased drag also delays multiple vortex transition, requiring progressively higher swirl to initiate the process. Dissert. Abstr.

N80-12658# Florida State Univ., Tallahassee. Dept. of Meteorology and Oceanography.
SURFACE METEOROLOGY OVER THE GATE A-SCALE
T. N. Krishnamurti and Ruby Krishnamurti Nov. 1978 50 p refs
(Contract N00014-75-C-0877)
(Rept-78-6; TR-16) Avail: NTIS HC A03/MF A01

A method of analysis for the surface motion field based on a mix of observations from research ships, merchant ships and low cloud motion vectors from geostationary satellites is proposed. The proposed scheme permits a turning of wind with height between the cloud wind level and the surface. Time averaged fields of the zonal and the meridional stresses as well as of the curl of the wind stress are illustrated. Spectral analysis of the motion field and the stresses over the trade wind belts of the summer and winter hemisphere were examined. Two modes of oscillation are emphasized, one around 3 to 6 days and the other around 10 to 15 days. While the former is identified with African waves, the scale and speed of propagation of the latter is determined from x-t diagrams and is identified as a westward propagating wave, whose scale is of the order of 40 deg longitude and speed of propagation is around 3 deg longitude/day. R.E.S.

N80-12659# Florida State Univ., Tallahassee. Dept. of Oceanography and Geophysical Fluid Dynamics Inst.
LABORATORY MODELLING OF OCEANIC RESPONSE TO MONSOONAL WINDS
Ruby Krishnamurti 1978 39 p refs Presented at IUTAM-IUGG Symp. on Monsoon Dynamics, Delhi, Dec. 1977
(Contract N00014-75-C-0877)
(TR-15) Avail: NTIS HC A03/MF A01

Fluid in a rotating tank of varying depth was subjected to various stress patterns simulating both steady and seasonally varying winds, including monsoonal winds. For a certain range of the governing parameters (Rossby number, Ekman number and Froude number), a homogeneous fluid displayed steady westward intensified flow. For the same range of parameters a two layer fluid had baroclinic instabilities. The parameter range for these instabilities was mapped in a regime diagram. The northward transport of the western boundary current was measured as it varied with imposed wind stress curl and compared with the corresponding values in a homogeneous fluid. The conditions for surfacing of the lower layer were measured as they varied with Rossby number and Froude number. K.L.

N80-12660# Committee on Commerce, Science, and Transportation (U. S. Senate).
WEATHER MODIFICATION: PROGRAMS, PROBLEMS, POLICY, AND POTENTIAL
Washington GPO 1978 776 p refs Rept. for Comm. on Commerce, Sci. and Transportation, 95th Congr., 2d Sess., May 1978 Prepared by the Library of Congr., Congressional Res. Service
(GPO-34-857) Avail: Comm. on Commerce, Sci., and Transportation

Technical, governmental, legal, economic, social, international, and ecological issues related to weather modification are reviewed.

Statements of the position of the White House, the Defense Department, and the United Nations on environmental modifications are included with state statutes concerning weather modification. A.R.H.

N80-12661*# National Aeronautics and Space Administration, Wallops Station, Wallops Island, Va.
WIND STUDY FOR HIGH ALTITUDE PLATFORM DESIGN
Thomas W. Strganac Washington Dec. 1979 288 p refs
(NASA-RP-1044) Avail: NTIS HC A13/MF A01 CSCL 04B

An analysis of upper air winds was performed to define the wind environment at potential operating altitudes for high altitude powered platform concepts. Wind conditions of the continental United States, Pacific area (Alaska to Sea of Japan), and European area (Norwegian and Mediterranean Sea) were obtained using a representative network of sites selected based upon adequate high altitude sampling, geographic dispersion, and observed upper wind patterns. A data base of twenty plus years of rawinsonde gathered wind information was used in the analysis. Annual variations from surface to 10 mb pressure altitude were investigated to encompass the practical operating range for the platform concepts. Parametric analysis for the United States and foreign areas was performed to provide a basis for vehicle system design tradeoffs. This analysis of wind magnitudes indicates the feasibility of annual operation at a majority of sites and more selective seasonal operation for the extreme conditions between the pressure altitudes of 100 to 25 mb based upon the assumed design speeds. R.C.T.

N80-12662*# Institute of Man and Science, Rensselaerville, N. Y.
POSITION PAPER ON THE POTENTIAL OF INADVERTENT WEATHER MODIFICATION OF THE FLORIDA PENINSULA RESULTING FROM NEUTRALIZATION OF SPACE SHUTTLE SOLID ROCKET BOOSTER EXHAUST CLOUDS Final Report, Apr. 1977 - Feb. 1978
Eugene Bollay, Lance Bosart, Earl Droessler, James Jiusto, G. Garland Lala, Volker Mohnen, Vincent Schaefer, and Patrick Squires Nov. 1979 204 p refs
(Contract NAS1-14965)
(NASA-CR-3091) Avail: NTIS HC A10/MF A01 CSCL 04B

A concept of injecting compounds into the exhaust cloud was proposed to neutralize the acidic nature of the low-level stabilized ground cloud (SGC) was studied. The potential Inadvertent Weather Modification caused by exhaust cloud characteristics from three hours to seven days after launch was studied. Possible effects of the neutralized SGC in warm and cloud precipitation processes were discussed. Based on a detailed climatology of the Florida Peninsula, the risk for weather modification under a variety of weather situations was assessed. R.C.T.

N80-12663*# Naval Weapons Center, China Lake, Calif.
AIRBORNE MEASUREMENTS OF CLOUD-FORMING NUCLEI AND AEROSOL PARTICLES IN STABILIZED GROUND CLOUDS PRODUCED BY SOLID ROCKET BOOSTER FIRINGS
Edward E. Hindman, II, G. Garland Ala (State Univ. of New York at Albany), Farn P. Parungo (NOAA, Boulder, Colo.), Paul T. Willis (NOAA, Coral Gables, Fla.), Richard J. Bendura (NASA, Langley Research Center), and David C. Woods (NASA, Langley Research Center) Oct. 1978 76 p refs
(NASA Order T-6782F)
(NASA-CR-160357; NWC-TM-3589) Avail: NTIS HC A05/MF A01 CSCL 04B

Airborne measurements of cloud volumes, ice nuclei and cloud condensation nuclei, liquid particles, and aerosol particles were obtained from stabilized ground clouds (SGCs) produced by Titan 3 launches at Kennedy Space Center, 20 August and 5 September 1977. The SGCs were bright, white, cumulus clouds early in their life and contained up to 3.5 g/m3 of liquid in micron to millimeter size droplets. The measured cloud volumes were 40 to 60 cu km five hours after launch. The SGCs contained high concentrations of cloud condensation nuclei active at 0.2%, 0.5%, and 1.0% supersaturation for periods of three to five hours. The SGCs also contained high concentrations of submicron particles. Three modes existed in the particle population: a 0.05 to 0.1 micron mode composed of aluminum-containing particles, a 0.2 to 0.8 micron mode, and a 2.0 to 10 micron mode composed of particles that contained primarily aluminum. K.L.

N80-12664*# Naval Weapons Center, China Lake, Calif. Research Dept.
LABORATORY INVESTIGATIONS OF CLOUD FORMING NUCLEI AND AEROSOL PARTICLES FROM UNPRESSURIZED BURNS OF SPACE SHUTTLE PROPELLANT Final Report
Edward E. Hindman, II, Dennis M. Garvey (Colo. State Coll.), Gerhard Langer (Natl. Center for Atmospheric Res.), F. Kirk Odencrantz, Farn P. Parungo (NOAA, Boulder, Colo.), and Gerald L. Gregory (NASA, Langley Res. Center) Dec. 1978 90 p refs
(NASA Order T-6782F)
(NASA-CR-160358; NWC-TM-3666) Avail: NTIS HC A05/MF A01 CSCL 04B

Laboratory measurements of the concentrations and compositions of ice nuclei, concentrations of cloud condensation nuclei and the size, concentrations, and compositions of aerosol particles were obtained from the effluent of unpressurized burns of solid rocket booster propellant from the space shuttle. All of the devices to measure ice nuclei detected high concentrations from the effluent. The portable counters indicated 200 to 1,000 times fewer ice nuclei than did the large, permanet cloud chamber. The filter devices indicated 10 to 100 times fewer ice nuclei than did the portable counters. The ice nuclei were composed primarily of Al2O3 with traces of other elements (mainly S and Ca). The effluent is a prolific source of cloud condensation nuclei; no activity spectra were determined because the counter was saturated. The sizes, concentrations, and compositions of the particles generated in the laboratory did not duplicate completely those characteristics of particles measured in the stabilized ground clouds from Titan 3 launches. M.M.M.

N80-12665# World Meteorological Organization, Geneva (Switzerland).
ON CLIMATE AND MANKIND
1979 803 p refs Proc. of lectures of the World Climate Conf., Geneva, 12-23 Feb. 1979
(WMO-537; ISBN-92-63-10537-5) Avail: NTIS HC A99/MF A01

Present knowledge of climatic change and variability due to both natural and anthropogenic causes is reviewed. Possible future changes and their implications for human activities are assessed. For individual titles, see N80-12666 through N80-12698.

N80-12666# National Academy of Sciences - National Research Council, Washington, D. C.
CLIMATE AT THE MILLENNIUM
Robert M. White *In* WMO On Climate and Mankind 1979 p 1-11 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The world conditions by the year 2000 are discussed with emphasis on the impact of man-induced climate modifications. The food and energy problems are analyzed. It is concluded that a serious effort to understand climate modification should be made by the international scientific community, and that an advisory role toward governments may help to formulate long range programs to prevent the consequences of undesirable climate change. Author (ESA)

N80-12667# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC CHANGE AND HUMAN STRATEGY
E. K. Fedorov (USSR State Comm. for Hydrometeorol. and Control of Natl. Environ., Moscow) *In: its* On Climate and Mankind 1979 p 15-26 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Because of the climatic changes that will inevitably occur in the future, man must have a desirable strategy. The first and basic element of that strategy is the forecasting of natural and man-made climate changes. A second element is an assessment of the consequences of the different types of climatic change, and the effectiveness of social organization in reducing undesirable consequences. The third element of the strategy is to make recommendations on how to avoid the adverse consequen-

ces of climate change, or to avoid such change altogether.
Author (ESA)

N80-12668# Stockholm Univ. (Sweden). Dept. of Meteorology.
GLOBAL ECOLOGY AND MAN
Bert Bolin *In* WMO On Climate and Mankind 1979 p 27-50 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The influence of man on regional and global processes within the biosphere is examined. Present knowledge on the carbon, nitrogen, sulphur and oxygen cycles is reviewed. An assessment of a possible future increase of atmospheric CO2 shows a large variation in predicted maximum concentration, depending on which assumption is adopted for CO2 adsorption by land biota. The response of the terrestrial and marine biota to a changing climate is discussed.
Author (ESA)

N80-12669# Toronto Univ. (Ontario). Inst. for Environmental Studies.
CLIMATIC VARIATION AND VARIABILITY: EMPIRICAL EVIDENCE FROM METEOROLOGICAL AND OTHER SOURCES
Kenneth F. Hare *In* WMO On Climate and Mankind 1979 p 51-87 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Existing evidence indicating climate change and the nature of climatic variation and variability, is examined, studying present weather and climate as well as previous climates. The recent trend of atmospheric and sea-surface temperatures is downward, at the rate of 0.1 to 0.2 deg per decade. It is not clear whether this will continue, and it may be offset by heating due to atmospheric contaminants like CO2. It is also concluded that high variability of temperature and precipitation during the 1970's may not, in fact, have been abnormal, and the best defenses against climatic anomalies is always to adopt economic practices that recognize their probable return.
Author (ESA)

N80-12670# Academy of Sciences (USSR), Moscow. Inst. of Geography.
CLIMATES OF PAST GEOLOGICAL EPOCHS
I. P. Gerasimov *In* WMO On Climate and Mankind 1979 p 88-111 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Present knowledge of paleoclimatology is reviewed. The technical means of analysis are discussed. In particular the evolution and variability of earth average temperature are studied as well as the tropospheric circulation and the distribution of glaciated areas. The possibility of anthropogenic warming of climate is also examined, but a clear conclusion is not reached regarding climate trends in the future.
Author (ESA)

N80-12671# Oregon State Univ., Corvallis.
THE PHYSICAL BASIS OF CLIMATE
Lawrence W. Gates *In* WMO On Climate and Mankind 1979 p 112-131 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The physical processes of climate and climatic change are reviewed. The discussion includes the climate system, the atmospheric-ocean interaction, the external influences and climatic history, the definition of climate and climatic change, the characteristics of climatic change, climate models and climate prediction, climate model hierarchy, climate predictability and the CO2 climate problem.
Author (ESA)

N80-12672# Akademiya Nauk SSSR, Novosibirsk. Central Computing Center.
MODELING OF CLIMATIC CHANGES AND THE PROBLEM OF LONG-RANGE WEATHER FORECASTING
G. I. Marchuk *In* WMO On Climate and Mankind 1979 p 132-153 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The main features of the mechanisms governing atmospheric dynamic processes are reviewed and atmospheric models are described. Subsequently the problem of estimation of climate change is analyzed. The sensitivity of climatic models is discussed, and a number of sensitivity studies of the climate system with respect to parameter variations are mentioned. Long range weather forecasting is examined, pointing out the verified conclusion, that detailed weather forecasts for more than two weeks in advance are, in general, hardly possible. As an example, a three dimensional comparatively simple model of thermal interaction of the atmosphere with the active layer of the world's ocean and land is presented.
Author (ESA)

N80-12673# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC MONITORING AND CLIMATIC DATA COLLECTION SERVICES FOR DETERMINING CLIMATIC CHANGES AND VARIATIONS. MONITORING DATA RELEVANT TO CLIMATE
Ju. A. Izrael (USSR State Comm. for Hydrometeorol. and Control of Natl. Environ., Moscow) *In its* On Climate and Mankind 1978 p 154-169 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatic monitoring and climatic data collection utility, practice, and developments are examined. Objectives considered include measurement of climatic parameters, analysis and assessment of natural and antropogenic changes and variations of climate, and the prediction of potential climatic variations. The priorities and accuracy of measurement in the development of climate monitoring and climatic data collection services are discussed. The role of satellites in climate monitoring is also described.
Author (ESA)

N80-12674# Toronto Univ. (Ontario). Inst. of Environmental Studies.
HUMAN ACTIVITIES THAT EFFECT CLIMATE
R. E. Munn and L. Machta (Natl. Oceanic and Atmos. Admin., Washington, D.C.) *In* WMO On Climate and Mankind 1979 p 170-209 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatic changes due to changing composition of the atmosphere, released heat, or changes of the physical and biological properties of the underlying surface are discussed. A 10% increase in atmospheric CFCL3 concentration observed in the period 1976-1978 is given as an example. Concentrations of CO2, SO2, dust particles, and Krypon-85 in the atmosphere are also discussed. Special considerations relating to the stratosphere are examined, in particular the effects of chlorofluormethanes, CO2, and CO on ozone content. The heat release and deforestation problems are also reviewed. It is concluded that few predictions call for significant climatic effects before the year 2000, and that further work is necessary to solve existing uncertainties.
Author (ESA)

N80-12675# Meteorological Office, Bracknell (England).
SOME RESULTS OF CLIMATE EXPERIMENTS WITH NUMERICAL RESULTS
B. J. Mason *In* WMO On Climate and Mankind 1979 p 210-242 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The characteristics of two three-dimensional general atmospheric circulation models are described and the results obtained with the models are discussed. The 11-level models are successful in simulating pressure, wind, temperature and rainfall patterns, and other climate parameters. An experiment with a 5-level model shows that the melting of the Arctic ice will have the unexpected result of producing a significant cooling in middle latitudes especially over the United States. A simulation of an ice age with the 11-level model shows a 10% reduction in total global rainfall. Calculations on the effects of doubling the atmospheric concentration of CO2 show a rise of global land surface temperature of only 0.4 deg K and a corresponding 1% increase in precipitation with strong latitudinal and regional differences.
Author (ESA)

N80-12676# Bonn Univ. (West Germany). Inst. of Meteorology.
A SCENARIO OF POSSIBLE FUTURE CLIMATES: NATURAL AND MAN-MADE
H. Flohn *In* WMO On Climate and Mankind 1979 p 243-266 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Warm and cold episodes of earth climate are analyzed,

including the medieval warming, the Holocene warm episode, the last interglacial epoch, the glaciated Antarctic versus ice-free Arctic scenario, the volcanic events and the Little Ice Age (1550-1850), and the possible initiation of a new ice age. It is concluded that a normal climate only exists in a very broad sense, and that many previous climate periods differed considerably from the present situation. However, the risks associated with a CO2 content that may reach 750-900 ppm should be seriously considered. Author (ESA)

N80-12677# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ENERGY AND CLIMATE: A REVIEW WITH EMPHASIS ON GLOBAL INTERACTIONS
J. Williams, W. Haefele, and W. Sassin *In* WMO On Climate and Mankind 1979 p 267-289 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The potential impact of energy systems on climate and the implications of the present state of knowledge on energy policy decision making are discussed. The impact of climate on energy supply and demand is examined. The requirements for climate information necessary to improve the assessment of energy climate interaction are outlined. Author (ESA)

N80-12678# National Oceanic and Atmospheric Administration, Silver Spring, Md. Hydrologic Services Div.
CLIMATE VARIABILITY AND THE DESIGN AND OPERATION OF WATER RESOURCE SYSTEMS
John C. Schaake, Jr. and Zdzislaw Kaczmarek (Inst. of Meteorol. and Water Management, Warsaw) *In* WMO On Climate and Mankind 1979 p 290-312 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The use of climatic information in water resources management is reviewed. The nature of streamflow variability and methods of accounting for its effects are examined. The use of stochastic hydrologic models and the role they are likely to play in the future are described. The relationship between storage, demand for water, and the risk of failing to meet water demands from a given reservoir is considered. Author (ESA)

N80-12679# University Hospital, Basel (Switzerland). Biological Central Lab.
CLIMATE, HEALTH AND DISEASE
Wolf H. Wolhe *In* WMO On Climate and Mankind 1979 p 313-368 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Various fields of human biometeorology are reviewed as a basis for a discussion of the possible effects on man of a major climatic variation in the near future. Climate in relation to the health of man, climate as a direct cause of disease, noncommunicable diseases, and communicable diseases are reviewed.
Author (ESA)

N80-12680# World Meteorological Organization, Geneva (Switzerland).
GLOBAL ASPECTS OF FOOD PRODUCTION
M. S. Swaminathan (Indian Council of Agr. Res., New Delhi) *In its* On Climate and Mankind 1979 p 369-504 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The world food situation, potential capacity, and programs for the near future are discussed. It is concluded that no time should be lost in building dependable and effective national and international food security systems based on known technology. A highly cooperative interaction between scientists and decision makers is called for. It is shown that actual food production is only 1/30 of the estimated maximum. Author (ESA)

N80-12681# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC VARIABILITY AND AGRICULTURE IN THE TEMPERATE REGIONS
James D. McQuigg *In its* On Climate and Mankind 1979 p 406-425 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The interaction of the temperate zone agricultural system with year climatic variability is discussed, examining first the impact on yields of climatic and agricultural development, and then analyzing the variability of crop season weather and the climate information system. It is shown that the yield increase observed since the 1950's seems to have reached a plateau, but future trends in grain yields and production must be related to future climate and technological developments. The climate information that will be most useful to crop prediction and agricultural practices is detailed, pointing out that long term weather records are a potential source of valuable management information. Author (ESA)

N80-12682# Kyoto Univ. (Japan). Center for Southeast Asian Studies.
CLIMATIC VARIABILITY AND AGRICULTURE IN TROPICAL MOIST REGIONS
Hayao Fukui *In* WMO On Climate and Mankind 1979 p 426-474 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Vulnerability of agriculture in the humid tropics to variable climate is analyzed, studying the influence of several parameters in various moist tropical regions, with particular reference to food production. It is concluded that cultivation of annual grain crops is highly risky in the humid tropics because of the probability of eventual land deterioration and susceptibility to rainfall variability. Root crops and tropical tree crops are less vulnerable. Lowland rice cultivation is the agricultural system best adapter to humid tropical conditions, and its vulnerability to rainfall variations could be decreased by better water control.
Author (ESA)

N80-12683# Consiglio Nazionale delle Ricerche, Rome (Italy).
CLIMATIC VARIABILITY AND AGRICULTURE IN THE SEMI-ARID TROPICS
Francesco Mattei *In* WMO On Climate and Mankind 1979 p 475-509 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Agroclimatic factors and the influence of climatic variability in various regions of the world are presented. It is concluded that traditional rain-fed agriculture of the semi-arid tropics shows in general a relatively high fragility with increasing variability of the rain pattern and lower yields than in extra-tropical or subtropical environments with similar climatic characteristics. One important reason for that effect is the poor suitability of crops and agricultural systems to variability of climate.
Author (ESA)

N80-12684# Central Meteorological Service, Peking (China).
CLIMATIC CHANGE AND THE EXPLOITATION OF CLIMATIC RESOURCES IN CHINA
Chang Chia-cheng, Wang Shao-wu (Peking Univ.), and Cheng Szu-c-chung (Acad. Sinica, Peking, China) *In its* On Climate and Mankind 1979 p 510-524 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Space-time characteristics of climatic change in China are described and the exploitation of climatic resources is discussed. General trends in temperature of various time scales in China up to 100 million years ago, the main features of the dryness-wetness distribution in the past 500 years and the distribution of correlation between circulation indexes and the high and low frequency dryness/wetness fluctuations are presented. China's policies for agriculture development are described, stressing the importance of climatic forecasting.
Author (ESA)

N80-12685# Buenos Aires Univ. (Argentina).
RENEWABLE RESOURCES AND AGRICULTURE IN LATIN AMERICA IN RELATION TO THE STABILITY OF CLIMATE
Juan J. Burgos *In* WMO On Climate and Mankind 1979 p 525-551 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The productivity of the soil in Latin America is studied in relation to climate characteristics. Annual rates of soil erosion are discussed for various climatic regions. The effects of adapting the monsoon savannas, the semi-arid regions, and the arid regions to more intensive agricultural use are analyzed, showing the interaction of these changes with climate, and in some cases

the harm derived from these changes. The climate on the micro, meso and macroscales appears to be affected by these actions. Author (ESA)

N80-12686# Ibadan Univ. (Nigeria). Dept. of Geography.
CLIMATIC VARIABILITY AND LAND USE: AN AFRICAN PERSPECTIVE
Julius S. Oguntoyinbo and Richard S. Odingo *In* WMO On Climate and Mankind 1979 p 552-580 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A highlight of climatic events in Africa is presented referring mainly to the south of the Sahara within the last few hundred years. The effects of climatic variability on land use characteristics under varying conditions are discussed, and the effect of man's impact on the environment are shown. Greater emphasis is laid on the areas marginal to the desert, which give a false sense of security to human occupation during periods of successively wet years, but are highly vulnerable in periods of drought. Author (ESA)

N80-12687# Technische Universitaet, Munich (West Germany). Dept. of Bioclimatology and Applied Meteorology.
CLIMATIC VARIABILITY AND FORESTRY
A. Baumgartner *In* WMO On Climate and Mankind 1979 p 581-607 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The characteristics of forest distribution on the globe, and the interaction between forests and regional climate are examined. Destructive forest operation and the vulnerability of tropical forest to the effects of exploitation are discussed. It is concluded that mankind should maintain the existing forest cover of the earth. The economical, ecological and social aspects of the problem are pointed out. Author (ESA)

N80-12688# Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
CLIMATIC VARIATION AND MARINE FISHERIES
D. H. Cushing *In* WMO On Climate and Mankind 1979 p 608-632 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The events in fisheries in recent decades are used to indicate the ways in which the biological production of the world oceans may be modified by climatic factors. The annual changes in recruitment to a single population of fishes vary by about an order of magnitude. It is suggested that such differences would be generated by changes in wind strength and direction, in solar radiation at the sea surface and in sea surface temperature in restricted areas where the larval fishes grow. Author (ESA)

N80-12689# World Meteorological Organization, Geneva (Switzerland).
CLIMATIC VARIABILITY, MARINE RESOURCES AND OFFSHORE DEVELOPMENT
T. F. Gaskell (Oil Ind. Intern. Explor. and Produc. Forum, London) *In its* On Climate and Mankind 1979 p 633-651 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The activities being carried out in marine resource development are surveyed, including the construction of ports, harbors and other coastal facilities, and ship routing in difficult climate situations. The impact of climatic variation is usually more important when considering short-term weather forecasts, but extremes of climate and long-term trends are important if catastrophies of gross overdesign are to be avoided. Oil is likely to remain the most important marine resource for the next few decades. Manganese nodules and similar seabed mineral concentrations may be valuable in the future. Author (ESA)

N80-12690# Wyoming Univ., Laramie.
CLIMATE AND ECONOMIC ACTIVITY
Ralph C. dArge *In* WMO On Climate and Mankind 1979 p 652-681 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The evidence on the impact of climatic changes on various economic sectors of several nations is reviewed. It is shown, as an example, that the economic cost to the United States of 1 deg C reduction in average temperature may cost as much as seven billion U.S. dollars per year. Some of the more obvious international repercussions of climatic variation are examined, including estimations of sensitivity of economic cost to precipitation and temperature change, benefit cost analysis of stratospheric aircraft fuel desulphurization, fluorocarbon pollution impact, and a discussion of the effects of nitrogen fertilizers on stratospheric pollution and of CO2 increase effect estimations. Author (ESA)

N80-12691# Clark Univ., Worcester, Mass. Graduate School of Geography.
CLIMATE AND SOCIETY: LESSONS FROM RECENT EVENTS
Robert W. Kates *In* WMO On Climate and Mankind 1979 p 622-691 refs (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The effects of extreme weather events (blizzards, droughts, floods, tropical cyclones, tornados and storms) and the long term human response to their recurrence are discussed. Studies were conducted in some 20 countries and at 40 sites. Contrasting issues regarding vulnerability reduction are examined showing, for example, that there are common situations in which attempting to improve situations in the long run, makes things worse; a classical case being the use of levees for flood control. It is concluded that if we acted upon what we already know, the world death toll from flood, drought and tropical cyclones could be reduced by 95% and property damage by 50%. Author (ESA)

N80-12692# World Meteorological Organization, Geneva (Switzerland).
REPORT ON DISCUSSIONS HELD DURING THE FIRST WEEK OF THE CONFERENCE
In its On Climate and Mankind 1979 p 695-708 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A summary of the discussions held at the world climate conference is presented. The importance of climate system modeling is emphasized, pointing out that the analysis of previously unknown influences such as atmospheric CO2 increase can be made only by using models to predict the future course of climate. The subjects discussed include: climate modeling, climatic variability, climatic scenarios, climate monitoring, climate and the biosphere, climate and the composition of the atmosphere, energy and climate, water resources, climate and health, agriculture, soil science, forests and climate, fisheries and climate, offshore development, and economical and social aspects. Author (ESA)

N80-12693# World Meteorological Organization, Geneva (Switzerland).
THE DECLARATION OF THE WORLD METEOROLOGICAL CONFERENCE: AN APPEAL TO NATIONS
In its On Climate and Mankind 1979 p 709-716 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

An appeal to nations is presented stating that it is important that the nations of the world: (1) take full advantage of man's present knowledge of climate; (2) take steps to improve significantly that knowledge, and (3) foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity. Detailed conclusions and recommendations are included. Author (ESA)

N80-12694# World Meteorological Organization, Geneva (Switzerland).
CLIMATE DATA
In its On Climate and Mankind 1979 p 719-726 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

The objectives of climate monitoring and data collection, and the data required for research, applications, and impact studies are discussed in order to provide supporting analysis to the declaration of the World Climate Conference. It is concluded that participating nations and international bodies should include in their priority programs a task list which is defined. Highest priority is given to the extension and improvement of existing climatological networks and to the development of an international compatible data system. Author (ESA)

N80-12695# World Meteorological Organization, Geneva (Switzerland).
APPLICATIONS OF THE KNOWLEDGE OF CLIMATE
In its On Climate and Mankind 1979 p 727-738 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Climatological information applications to a wide variety of planning and operational activities are reviewed in a supporting document to the declaration of the world conference. A list of priorities is presented referring to socio-economic sectors such as food production, water resources, energy, and human health, and to areas of international action such as data information systems, education and training programs, technology transfer, promotion of the use of applications, and development of new technologies. The organizational problem and the goals of the climate applications program are also discussed. Author (ESA)

N80-12696# World Meteorological Organization, Geneva (Switzerland).
THE INFLUENCE OF SOCIETY ON CLIMATE CHANGE AND VARIABILITY
In its On Climate and Mankind 1979 p 739-743 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

Human influence on climate is discussed. The issues examined include the effects of: CO2 release in the atmosphere, infrared absorbing gases, changes in the land surface, stratospheric changes, aerosols, heat emissions, weather modifications, and military activities. It is concluded that the most urgent attention should be given to the impact of the accumulation of CO2 in the atmosphere. Concern also arises with regard to the potential increases in other trace gases which have a greenhouse effect and a long residence time in the atmosphere. Author (ESA)

N80-12697# World Meteorological Organization, Geneva (Switzerland).
IMPACTS OF CLIMATE CHANGE AND VARIABILITY ON SOCIETY
In its On Climate and Mankind 1979 p 744-750 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

In order to assess the impact of climate change on society a study is proposed with the following objectives: (1) improvement of our knowledge of the specific primary responses and interactive relations, (2) improvement of the methodology employed, and (3) identification of the characteristics of human societies especially vulnerable or resilient to climate variability. A list of priority criteria and a discussion of the methods to be employed are given. Author (ESA)

N80-12698# World Meteorological Organization, Geneva (Switzerland).
RESEARCH ON CLIMATIC CHANGE AND VARIABILITY
In its On Climate and Mankind 1979 p 751-758 (For primary document see N80-12665 03-47)
Avail: NTIS HC A99/MF A01

A world climate research program is proposed which will attempt, through international cooperation, to determine why, how, and where climate changes and variations occur, and thereby attempt prediction of their future occurence. The major objectives are to establish to what extent climate can be predicted, and the extent of man's influence on climate. The definitions, an analysis of research elements and a discussion on data requirements for climate research are presented. A list of scientific priorities is also presented. Author (ESA)

N80-12699# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
THE 19304DT GSRS, MISSILE NO. 1031, ROUND NO. V-46 Data Report
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073388; ERADCOM/ASL-DR-1037) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19304DT GSRS, Missile Number 1031, Round Number V-46, are presented in tabular form. GRA

N80-12700# Atmospheric Science Associates, Bedford, Mass.
COLLECTION AND MEASUREMENT EFFICIENCIES OF THE EWER CLOUD WATER METER FOR HYDROMETEORS Final Report, 1 Apr. - 31 May 1979
Hillyer G. Norment 11 May 1979 40 p refs
(Contract F19628-79-M-0005; AF Proj. 2310)
(AD-A072827; AFGL-TR-79-0122) Avail: NTIS HC A03/MF A01 CSCL 04/1

Calculated collection and measurement efficiencies for an airborne EWER cloud water content meter are presented for water drops and five types of ice crystals for three flight altitudes and for wide ranges of particle sizes. Particle type and size effects are found for very small particles, but the results are essentially constant for particles heavier than about 0.5 micrograms. GRA

N80-12701# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Science Lab.
THE 14818C LANCE, MISSILE NUMBER 3396, ROUND NUMBER 333 APL Meteorological Data Report
Jun. 1979 26 p
(DA Proj. 1T6-65072-D-126)
(AD-A073109; ERADCOM/ASL-DR-1029) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14818C Lance, Missile No. 3396, Round No. 333 APL, are presented in tabular form. GRA

N80-12702# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19702A GSRS, MISSILE NUMBER 336, ROUND NUMBER B-19
Jun. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073110; ERADCOM/ASL-DR-1032) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 336, Round Number B-19, are presented in tabular form. GRA

N80-12703# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19702A GSRS, MISSILE NUMBER 302, ROUND NUMBER B-20
Jun. 1979 18 p
(DA Proj. 1T6-65702-D-126)
(AD-A073111; ERADCOM/ASL-DR-1033) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19702A GSRS, Missile Number 302, Round Number B-20, are presented in tabular form. GRA

N80-12704# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305AT GSRS, MISSILES NUMBER 1042, 1039, ROUNDS NUMBER V-44, V-45
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073112; ERADCOM/ASL-DR-1035) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305AT GSRS, Missiles Number 1042 and 1039, Rounds Number V-44 and V-45, are presented in tabular form. GRA

N80-12705# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 19305AT GSRS, MISSILE NUMBER 1040, ROUND NUMBER V-43
Jun. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A073188; ERADCOM/ASL-DR-1034) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19305AT

GSRS, Missile Number 1040, Round Number V-43, are presented in tabular form. GRA

N80-12706# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 1930AT GSRS, MISSILES NUMBER 1028, 1036, 1034, ROUNDS NUMBER V-40, V-41, V-42
21 Jun. 1979 20 p
(DA Proj. 1T6-65702-D-167)
(AD-A073187; ERADCOM/ASL-DR-1031) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 1930AT GSRS, Missiles No. 1028, 1036, 1034, Rounds No. V-40, V041, V-42, are presented in tabular form. GRA

N80-12707# Northrop Services, Inc., Huntsville, Ala.
SOLAR-CLIMATIC STATISTICAL STUDY. SUMMARY REPORT, VOLUME 1
Roger E. Bray Feb. 1979 60 p refs 2 Vol.
(Contract EG-77-C-01-4016)
(HCP/T4016-1) Avail: NTIS HC A04/MF A01

Data at 26 (SOLMET) National Weather Service stations were processed to provide preliminary planning data, in the form of statistical information, for selected daily average solar and wind conditions occurring and persisting for time periods of interest. Empirical probabilities were constructed from the historic solar and wind data to provide a reasonable inference of the chance of similar climatological conditions occurring at any given time. (Diurnal wind power variations were also considered). Data used to obtain the daily average solar and wind power probabilities were combined into monthly averages and are presented. Average monthly, seasonal and annual solar and wind power trends were prepared to provide an overview for identifying areas for further investigation. DOE

N80-12708# Hawaii Univ., Honolulu. Dept. of Meteorology.
SUMMER WEATHER ON HALEAKALA, MAUI
S. W. Lyons Apr. 1979 65 p refs
(Grant EG-77-G-03-1617)
(UHMET-79-09) Avail: NTIS HC A04/MF A01

Meteorological observations from the summit of Haleakala, Maui, high-resolution satellite imagery, and rainfall climatology were examined to determine diurnal and day to day variations in weather both at the summit and along the slopes. Results show largest weather variations occur in response to the diurnal mountain heating cycle, while day to day weather changes result from continuous and systematic interaction between the local diurnal cycle and synoptic weather patterns. The diurnal cycle produces afternoon maxima and early morning minima in summit temperature, humidity, cloudiness, and rainfall. Summit maximum temperature and cloud amount depend directly on synoptic wind profiles and hydrostatic stability, while minimum temperature is positively correlated (R = .78) with the antecedent maximum temperature. Multiple regression equations were derived for summit humidity, cloud amount, maximum and minimum air temperatures, and wake cloud plume development. DOE

N80-12709# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.
WIND TIME SERIES ANALYSES FOR WECS APPLICATIONS
Jack W. Reed Dec. 1978 42 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1701) Avail: NTIS HC A03/MF A01

A methodology for wind power analyses of wind speed time series is described, including computation flow diagrams and a FORTRAN program listing. Examples of results are presented but complete outputs will follow in specialized reports. Primary calculation states are: (1) data homogenization for moved anemometers; (2) extrapolations to selected standardized heights; (3) distribution smoothing for observation bias; (4) power distribution function calculation; (5) turbine speed limit effects analysis; (6) time variability assessment; and (7) analysis of light wind durations. DOE

N80-12710# Midwest Research Inst., Golden, Colo.
WIND RESOURCE ANALYSIS
Donald M. Hardy Dec. 1978 20 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-36-088) Avail: NTIS HC A02/MF A01

Modern atmosphere models of near-surface wind flow and primary data sets were developed from previous studies of national and regional wind resources. Because numerous assumptions are necessary to interpret available data in terms of wind energy potential, conclusions of previous studies differ considerably. The primary data sets and principal features of the models are discussed. DOE

N80-12711# Institute for Energy Analysis, Oak Ridge, Tenn.
CLIMATE MODELS AND THE PREDICTION OF CO2-INDUCED CLIMATIC CHANGES
R. G. Watts Dec. 1978 41 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-78-24-(M)) Avail: NTIS HC A03/MF A01

The carbon dioxide (CO2) content of the atmosphere has shown a systematic increase each year since regular measurements began in 1958. A major source of CO2 is the combustion of fossil fuels. An assimilation of the results of studies of the sensitivity of climate to increases in the CO2 content of the atmosphere are presented. Various atmospheric feedbacks and ice albedo feedback are discussed. Recent estimates of the various feedbacks were used to estimate upper and lower bounds of the globally averaged temperature increase that would accompany a doubling of atmospheric CO2 content. The results of a CO2 doubling experiment using a general circulation model are presented, and the possible response of the cryosphere is discussed. DOE

N80-12712# California Univ., Livermore. Lawrence Livermore Lab.
REGIONAL WIND-FIELD STUDY IN COMPLEX TERRAIN DURING SUMMER SEA-BREEZE CONDITIONS
W. M. Porch, P. A. Volker, K. R. Peterson, R. L. Weichel, and C. Sherman 5 Mar. 1979 26 p refs
(Contract W-7405-eng-48)
(UCRL-52680) Avail: NTIS HC A03/MF A01

A regional scale data base, consisting of wind and temperature data for June and July of 1977, was developed for the greater San Francisco Bay area and eastward to the Central Valley. Continuous meteorological measurements were made in the area of Patterson Pass about 3 km east of Lawrence Livermore Laboratory. This area was chosen because of its complex terrain and importance as a downwind topographic feature affecting the dispersal of possible accidental atmospheric releases from the laboratory and as an area of high wind energy potential. Summer sea breeze oscillations of about 6 and 12 days were characterized and an optical space-averaging wind sensor was successfully applied over a 1 kilometer path across the pass to provide long-path averaged data for regional, numerical wind field models with kilometer-sized grid elements. DOE

N80-12713# National Weather Service, Salt Lake City, Utah.
AIDS FOR FORECASTING MINIMUM TEMPERATURE IN THE WENATCHEE FROST DISTRICT
Robert S. Robinson Apr. 1979 15 p
(PB-298339/3; NOAA-TM-NWS-WR-139; NOAA-79062907)
Avail: NTIS HC A02/MF A01 CSCL 04B

Regression equations and their graphical solutions were developed as aids for forecasting the lowest minimum temperature among frost key stations in the Wenatchee frost district on a given night during the spring. Two aids were developed, one based on morning data for the preliminary frost forecast and one based on evening data for the primary forecast. Both require that nights have no more than scattered clouds or thin cirrus. Verification on independent data showed both equations to be quite useful. To further improve their usefulness, more study is needed to objectively determine whether or not sufficient cloudiness will be present to affect minimum temperatures. GRA

N80-12714# Electronic Techniques, Inc., Fort Collins, Colo.
SIERRA COOPERATIVE PROJECT (SCPP) FORECASTING SUPPORT, VOLUME 1 Interim Progress Report, 1 Dec. 1978 - 30 Jun. 1979
J. Owen Rhea and John L. Lecompte Jun. 1979 121 p refs
(Contract DI-9-07-85-V0021)

(PB-298497/9) Avail: NTIS HC A08/MF A01 CSCL 04B

The feasibility of using weather modification for improving water resources in the Sierra Nevada is discussed. Field services performed and analyses completed in support of the SCPP are summarized along with collection, reduction, and archiving of the data. GRA

N80-12715# National Weather Service, Salt Lake City, Utah.
COMPARISON OF LFM AND MFM PRECIPITATION GUIDANCE FOR NEVADA DURING DOREEN
Christopher D. Hill Apr. 1979 20 p refs
(PB-298613/1; NOAA-TM-NWS-WR-141; NOAA-79062909) Avail: NTIS HC A02/MF A01 CSCL 04B

A brief qualitative case study comparison of limited-area fine mesh (LFM) and movable fine mesh (MFM) precipitation forecasts is presented. During the surge of precipitation into the Southwestern United States from the remnants of Hurricane Doreen, the LFM appeared to provide better quantitative precipitation forecast (QPF) guidance than the finer mesh, more physically realistic MFM. However, at least in this one case, the apparent superior skill was possibly superficial. The LFM, unable to resolve the split in the moisture surge, forecast a single center of activity. The MFM successfully delineated the split. GRA

N80-12716# National Weather Service, Salt Lake City, Utah.
THE INFLUENCE OF CLOUDINESS ON SUMMERTIME TEMPERATURES IN THE EASTERN WASHINGTON FIRE WEATHER DISTRICT
James Holcomb Apr. 1979 16 p
(PB-298674/3; NOAA-TM-NWS-WR-140; NOAA-79062908) Avail: NTIS HC A02/MF A01 CSCL 04B

A relationship between surface temperature change and cloud-cover change was determined objectively for several weather zones in eastern Washington. This was combined with a measure of the general air-mass temperature change to produce equations which explained about 70 to 80% of the daily variation in surface temperature. The average error of the prediction equations when tested on two seasons of independent data was about 2 to 3 F. The equations may also apply to other areas in the Pacific Northwest at similar latitudes or others could similarly be derived. GRA

N80-12717# National Oceanic and Atmospheric Administration, Washington, D. C. National Climate Program Office.
PROCEEDINGS OF THE ANNUAL CLIMATE DIAGNOSTICS WORKSHOP
Nov. 1978 258 p refs Workshop held at Miami Univ., Fla., 31 Oct. - 2 Nov. 1978
(PB-298355/9; NOAA-79062901) Avail: NTIS HC A16/MF A01 CSCL 04B

Connections between terrestrial hydrology and ocean thermodynamics and the potential for affecting regional climate were considered. Development of credible climate prediction techniques was discussed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-12718*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REMOTE SENSING AND PROBLEMS OF THE HYDROSPHERE
Edward D. Goldberg, ed. (Scripps Institution of Oceanography, La Jolla, Calif.) Washington Dec. 1979 67 p refs Workshop held at Warner Springs, Calif., 29-31 Jan. 1979; sponsored by NASA, Langley Res. Center and NASA, Washington
(NASA-CP-2109; L-13404) Avail: NTIS HC A04/MF A01 CSCL 08J

A discussion of freshwater and marine systems is presented including areas of the classification of lakes, identification and quantification of major functional groups of phytoplankton, sources and sinks of biochemical factors, and temporal and regional variability of surface features. Atmospheric processes linked to hydrospheric process through the transfer of matter via aerosols and gases are discussed. Particle fluxes to the aquatic environment and global geochemical problems are examined. A.W.H.

N80-12719*# System Planning Corp., Arlington, Va.
DATA REQUIREMENTS FOR OCEANIC PROCESSES IN THE OPEN OCEAN, COASTAL ZONE, AND CRYOSPHERE
R. G. Nagler and S. W. McCandless, Jr. Sep. 1978 70 p refs Prepared for JPL
(Contract JPL-955068)
(NASA-CR-162451) Avail: NTIS HC A04/MF A01 CSCL 08C

The type of information system that is needed to meet the requirements of ocean, coastal, and polar region users was examined. The requisite qualities of the system are: (1) availability, (2) accessibility, (3) responsiveness, (4) utility, (5) continuity, and (6) NASA participation. The system would not displace existing capabilities, but would have to integrate and expand the capabilities of existing systems and resolve the deficiencies that currently exist in producer-to-user information delivery options. R.E.S.

N80-12720*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF COASTAL UPWELLING AND THE PRODUCTION OF A BIOMASS
John T. Howe Nov. 1979 28 p refs
(NASA-TM-78614; A-7931) Avail: NTIS HC A03/MF A01 CSCL 08A

The coastal upwelling index derived from weather data is input to a set of coupled differential equations that describe the production of a biomass. The curl of the wind stress vector is discussed in the context of the physical extent of the upwelling structure. An analogy between temperature and biomass concentration in the upwelled coastal water is derived and the relationship is quantified. The use of remote satellite or airborne sensing to obtain biomass rate production coefficients is considered. K.L.

N80-12721# California Univ., Berkeley. Dept. of Physics.
DESCRIPTION OF NONLINEAR INTERNAL WAVE INTERACTIONS USING LANGEVIN METHODS
Neil Pomphrey, James D. Meiss, and Kenneth M. Watson May 1979 58 p refs
(Contract N00014-78-C-0050)
(AD-A069010; UCB/PTH-79/4) Avail: NTIS HC A04/MF A01 CSCL 08/3

A comparison is made between several different methods for calculating energy transport within a wave field. Two Langevin techniques are developed. The first is based on the fluctuation dissipation theorem and provides relaxation rates nu(F) and a transport equation. The second method is an application of the Krylov-Bogoliubov-Mitropolsky perturbation theory and provides a Langevin rate constant nu(P) at lowest order. The two formulations are shown to be closely related to the radiative transfer (Boltzmann) equation whose rate is the difference between nu(F) and nu(P). Specific application of the Langevin methods is to internal waves in the ocean. Computations show that the GM-76 spectrum is approximately an equilibrium spectrum except for frequencies near the inertial frequency and at the lowest vertical mode numbers. The sensitivity of nu(F) and nu(P) to spectral form is also discussed. Simple analytic expressions for the rates are derived for the induced diffusion, elastic scattering, and parametric subharmonic instability mechanisms. Only the first of these mechanisms is ever of much numerical significance. Finally, net energy flow in the non-equilibrium portion of the GM-76 spectrum is discussed. GRA

N80-12722# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
REPORT TO THE CONGRESS ON COASTAL ZONE MANAGEMENT. TRANSITION QUARTER AND FISCAL YEAR 1977
Jan. 1979 113 p
(PB-298537/2; NOAA-79061803) Avail: NTIS HC A06/MF A01 CSCL 13B

This report contains separate sections on: identification of the state programs approved during the preceding Federal fiscal year and a description of those programs; listing of the states

participating and a description of the status of each state's program and its accomplishments during the preceding Federal fiscal year; itemization of the allocation of funds to the various coastal states and a breakdown of the major projects and areas; an identification of any state programs which have been reviewed and disapproved and which grants have been terminated and a statement for the reasons for such action; activities and projects which are not consistent with an approved state management program; and a summary of regulations issued by the Secretary or in effect during the preceding Federal fiscal year. GRA

N80-12723# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
THE FIRST FIVE YEARS OF COASTAL ZONE MANAGEMENT
Mar. 1979 66 p
(PB-298780/7; NOAA-79061802) Avail: NTIS HC A04/MF A01 CSCL 13B

Efforts to protect coastal wetlands, dunes, beaches, and other significant natural resources are described and assessed. It appears that coastal development is managed rationally. State coastal zone management (CZM) programs protect cultural, historic, and aesthetic resources in coastal areas, and in a number of states the permitting process for coastal development consistent with state CZM policies is simplified and streamlined. K.L.

N80-12724# Massachusetts Inst. of Tech., Cambridge. Lab. of Water Resources and Hydrodynamics.
AN ANALYSIS OF LONGSHORE CURRENTS AND ASSOCIATED SEDIMENT TRANSPORT IN THE SURF ZONE
D. W. Ostendorf and O. S. Madsen Apr. 1979 195 p refs (Grant NOAA-04-6-158-44081)
(PB-298291/6; MITSG-79/13; NOAA-79061811) Avail: NTIS HC A09/MF A01 CSCL 13B

Two momentum based longshore current models and a preliminary longshore sediment transport model are derived, calibrated, and tested. Calibration yields physically plausible behavior for the three model parameters while fixed bed, laboratory movable bed, and field testing show a general longshore current model accuracy of about 20%, where the latter two data bases only test the linear longshore current model. The linear longshore sediment transport model matches the laboratory data to an accuracy of about 20% but overpredicts the field data by a factor of 5; in view of the latter finding, the model should only be considered as an order of magnitude estimator of longshore sediment transport. Examples of the three models are presented. GRA

N80-12725# National Ocean Survey, Rockville, Md.
TIDE TABLES 1980. HIGH AND LOW WATER PREDICTIONS. EAST COAST OF NORTH AND SOUTH AMERICA INCLUDING GREENLAND
1979 302 p
(PB-298726/1; NOAA-79070301) Avail: NTIS HC A14/MF A01 CSCL 08C

Full daily predictions for 38 reference ports and differences and other constants for about 2,000 stations in North America, South America, and Greenland are presented. Other data given include local mean time of sunrise and sunset at different latitudes for every fifth day of the year, moonrise and sunrise for eight places, the time of solar equinoxes and solstices, and a table of the Greenwich mean time of the moon's phases, apogee, perigee, greatest north and south, and zero declination. Tables are also provided for reducing local mean time to standard time and obtaining the approximate height of the tide at any time. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-12726 New York Univ., N. Y.
NUMERICAL SOLUTION OF A HYPERBOLIC SYSTEM OF CONSERVATION LAWS FOR BLOOD FLOW IN THE ARTERIAL TREE Ph.D. Thesis
David Moise Bellehsen 1979 130 p
Avail: Univ. Microfilms Order No. 7925440

A code for an arbitrary arterial tree was developed that can accommodate any prescribed physiological data. The partial differential equations which describe the flow of blood in the cardiovascular system are nonlinear. The flow is treated as one-dimensional. The equations form a hyperbolic system of conservation laws which are solved by the Lax-Wendroff method. Special cases of one branch and three branches were worked out numerically and analytically with computed results in the form of tables. As an application, a structured arterial tree was studied and some graphs are presented. The effect of varying the reflection coefficient is also discussed. Dissert. Abstr.

N80-12727 Ohio Univ., Athens.
HUMAN MUSCLE FIBER TYPES IN POWER LIFTERS, DISTANCE RUNNERS AND UNTRAINED SUBJECTS: A HISTOCHEMICAL AND ULTRASTRUCTURAL STUDY Ph.D. Thesis
Frederick Paul Prince 1979 39 p
Avail: Univ. Microfilms Order No. 7924429

Cellular aspects (fiber size and qualitative measures of contraction time and aerobic capacity via histochemistry) and sub-cellular (morphometric analysis of mitochondrial volume percent, lipid volume percent and Z-line width via electron microscopy) aspects of the vastus lateralis muscle, a major extensor of the knee joint, in male and female athletes and non-athletes were investigated. The cross-sectional area and metabolic profile was obtained for each fiber. The fibers were thus classified as slow-twitch-oxidative, fast-twitch-oxidative-glycolytic, and fast-twitch-glycolytic. Much individual variation is present in the percentages of histochemical fiber types and fiber cross-sectional area. Male and female fibers are similar in most respects. The major difference being that all 3 fiber types appear larger in males. Dissert. Abstr.

N80-12728 Utah Univ., Salt Lake City.
STATISTICAL REPRESENTATION OF ELECTROCARDIOGRAPHIC BODY SURFACE MAPS FOR FEATURE IDENTIFICATION DATA COMPRESSION AND CLASSIFICATION Ph.D. Thesis
Arnold Kerry Evans 1979 96 p
Avail: Univ. Microfilms Order No. 7924352

The development and evaluation of methods for providing accurate representation of ECG body surface potential map data are discussed. Identifying diagnostically important map features, providing data compression, and forming a basis for applying statistical pattern recognition techniques to map classification are studied. Dissert. Abstr.

N80-12729 Michigan Univ., Ann Arbor.
A POSTURAL MEASUREMENT SYSTEM FOR INDUCED BODY SWAY ASSESSMENT Ph.D. Thesis
Robert Owens Andres 1979 162 p
Avail: Univ. Microfilms Order No. 7925105

A microcomputer based stimulus delivery and response measurement system for the analysis of human sagittal plane body sway response to induced instabilities was developed. The system is called a postural measurement system (PMS). The PMS provides flexibility in stimulus delivery while assessing postural sway responses with known resolution. The PMS was implemented in a predesigned factorial experiment investigating both static and induced sinusoidal body sway responses of one healthy young male subject; PMS performance was monitored concurrently with the human sway responses. The spectrum of antero-posterior body sway during quiet stance was non-adaptive over the 45 minute test session. The waist swayed less than the shoulders; most sway displacement had frequency components

less than .4 Hz. The lumbosacrum did not remain rigid during static sway as inverted pendulum body models assume.
Dissert. Abstr.

N80-12730*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SIMULTANEOUS MUSCLE FORCE AND DISPLACEMENT TRANSDUCER Patent Application
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), and Virgil H. Culler, inventors (to NASA) (JPL) Filed 30 Sep. 1977 12 p Sponsored by NASA
(NASA-Case-NPO-14212-1; US-Patent-Appl-SN-838308) Avail: NTIS HC A02/MF A01 CSCL 06B

A myocardial transducer for simultaneously measuring force and displacement within a very small area of myocardium is presented. Each branch of the forked transducer constitutes a low compliance tine for penetrating the heart. When the heart is penetrated, the surface membrane closes around indentations in the tines. A small piezoresistive element that converts a force into an electrical signal is bonded to one of the low compliance tines. A third high compliance tine is of a length that just pierces the surface membrane. Displacement of the myocardium in a direction in line with the two low compliance tines causes a deformation in curvature of the high compliance tine that is converted into an electrical signal by a second piezoresistive element. An electrode placed on the epicardium and referenced to the transducer provides an ECG with force and displacement measurements. NASA

N80-12731# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DESIGN OF A MICROPROCESSOR BASED CARDIOTACHOMETER
D. Ratino, G. Potor, A. Marko, and C. Sharper Apr. 1979 39 p refs
(AF Proj. 6893)
(AD-A073105; AMRL-TR-79-21) Avail: NTIS HC A03/MF A01 CSCL 09/2

A microprocessor based cardiotachometer has been designed and fabricated in-house using 8080 Intel microcomputer hardware and assembly language software. The cardiotachometer accurately calculates and digitally displays beat-by-beat heart rate in beats per minute. The design incorporates standard semiconductor memory and I/O integrated circuits. Operational understanding does not require extensive microprocessor design background. In fact, the cardiotach's design provides excellent basic information in the use of microprocessors in the instrumentation field. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-12732*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SINGLE PILOT SCANNING BEHAVIOR IN SIMULATED INSTRUMENT FLIGHT
Jack E. Pennington Oct. 1979 55 p refs
(NASA-TM-80178) Avail: NTIS HC A04/MF A01 CSCL 05I

A simulation of tasks associated with single pilot general aviation flight under instrument flight rules was conducted as a baseline for future research studies on advanced flight controls and avionics. The tasks, ranging from simple climbs and turns to an instrument landing systems approach, were flown on a fixed base simulator. During the simulation the control inputs, state variables, and the pilots visual scan pattern including point of regard were measured and recorded. Author

N80-12733# Hughes Aircraft Co., Culver City, Calif. Display Systems Lab.
DETECTION OF DIFFERENT TARGET TYPES IN REALISTIC TERRAIN Interim Report, Sep. 1978 - Jan. 1979
G. E. Corrick Mar. 1979 42 p refs
(Contract N60530-78-C-0240)
(AD-A072973; HAC-FR-79-27-676; HAC-Ref-E3900; NWC-TP-6107) Avail: NTIS HC A03/MF A01 CSCL 17/8

The effects of target and terrain characteristics on visual air-to-ground target acquisition were studied. Five target types--a portable bridge; a portable bridge with adjacent anti-aircraft artillery (AAA); a surface-to-air missile (SAM) site; a petroleum, oil, and lubricants (POL) supply dump; and a group of three tanks--were embedded into oblique aerial photos of real terrain at a simulated slant range of 1.6 km. Background scenes were selected to represent desert, desert/mountain, and rural terrain. Results of a search experiment showed that target type was the most important factor in determining acquisition performance, accounting for up to 40% of the experimental variance. The relative detectabilities of the target were found to group so that the bridge alone, the bridge with AAA site, and the SAM site were significantly easier to detect than the three tank group or POL site. Results are discussed in terms of the detectability of a target as related to the constraints on its possible scene location. Background was shown to be a significant effect, but accounted for about one-fourth as much of the variance as did target type. These results are compared to a previous similar study using multiple configurations of a single target type where background characteristics were shown to account for more variance. Implications for target acquisition modeling are discussed. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-12734 Michigan Univ., Ann Arbor.
RATIONAL WAYS TO INCREASE PICTOGRAPHIC SYMBOL DISCRIMINABILITY Ph.D. Thesis
Paul Allan Green 1979 237 p
Avail: Univ. Microfilms Order No. 7925156

Several ways of increasing the discriminability of similar symbols were compared. Six alterations were considered; five modifications of symbol elements (changes in height to width ratio, strokewidth, rotation in the frontal plane, repetition, and filling in an enclosed area) and substitution of a new symbol (new prototype) for one member of a confusable pair. The last four changes were compared. To determine the effect of including confusable pairs of symbols in larger sets, symbols for several controls and displays (heater, air conditioner, vent, radio volume and tuning, exterior-lamp failure, and tire pressure) were developed. Suggestions for those symbols were drawn by 43 drivers in experiment two. Based on those drawings were several candidate symbols for each function. In the third experiment 62 drivers made magnitude estimates of how well each candidate's intended meaning was understood. From these data and existing standards a set of eight symbols was assembled. Dissert. Abstr.

N80-12735*# Georgia Inst. of Tech., Atlanta.
GUIDING THE DEVELOPMENT OF A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM
Robert M. Mason, ed. (Metrics, Inc., Atlanta) and John L. Carden, ed. Nov. 1979 98 p refs Report on workshop held at NASA/Ames, 8-12 Jan. 1979
(Grant NsG-2323)
(NASA-CR-162452) Avail: NTIS HC A05/MF A01 CSCL 06K

The workshop is reported which was held to establish guidelines for future development of ecological support systems, and to develop a group of researchers who understand the interdisciplinary requirements of the overall program. For individual titles, see N80-12736 through N80-12738.

N80-12736*# Georgia Inst. of Tech., Atlanta.
EVALUATION OF A GROUND BASED MANNED DEMONSTRATION AS A MILESTONE IN CELSS DEVELOPMENT
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 8-75 (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

The requirements for a ground based manned controlled ecological life support system demonstration are summarized for the following: nutrition and food processing, food production, waste processing, systems engineering and modeling, and ecology-systems safety. F.O.S.

N80-12737*# Georgia Inst. of Tech., Atlanta.
DEVELOPMENT REQUIREMENTS FOR A SUCCESSFUL GROUND BASED CELSS DEMONSTRATION
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 16-49 refs (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

Considerations critical to a ground based control demonstration were identified. The controlled ecological life support system technologies were assessed for nutrition and food processing, food production, waste processing, and systems engineering/modeling. F.O.S.

N80-12738*# Georgia Inst. of Tech., Atlanta.
RESEARCH RECOMMENDATIONS
In its Guiding the Development of a Controlled Ecological Life Support System Nov. 1979 p 51-69 (For primary document see N80-12735 03-54)
Avail: NTIS HC A05/MF A01 CSCL 06K

The research and development sequences and priorities for CELSS development were established for each of the following areas: nutrition and food processing, food production, waste processing, systems engineering/modeling, and ecology-systems safety. F.O.S.

N80-12739*# Society of Automotive Engineers, Inc., New York. Bioenvironmental Systems Study Group.
EVALUATION AND COMPARISON OF ALTERNATIVE DESIGNS FOR WATER/SOLID-WASTE PROCESSING SYSTEMS FOR SPACECRAFT Final Report
J. M. Spurlock Jul. 1975 135 p refs
(Contract NASw-2439)
(NASA-CR-162492) Avail: NTIS HC A07/MF A01 CSCL 06K

Promising candidate designs currently being considered for the management of spacecraft solid waste and waste-water materials were assessed. The candidate processes were: (1) the radioisotope thermal energy evaporation/incinerator process; (2) the dry incineration process; and (3) the wet oxidation process. The types of spacecraft waste materials that were included in the base-line computational input to the candidate systems were feces, urine residues, trash and waste-water concentrates. The performance characteristics and system requirements for each candidate process to handle this input and produce the specified acceptable output (i.e., potable water, a storable dry ash, and vapor phase products that can be handled by a spacecraft atmosphere control system) were estimated and compared. Recommendations are presented. R.E.S.

N80-12740# Wisconsin Univ. - Milwaukee. Dept. of Systems Design.
SOME MODELS OF HUMAN ERROR FOR MAN-MACHINE SYSTEM EVALUATION Final Technical Report, 1 Jul. 1977 - 30 Dec. 1978
Marlin U. Thomas 15 May 1979 32 p refs Prepared in cooperation with Chrysler Corp., Detroit and Michigan Univ., Ann Arbor
(Contract N00014-77-C-0587)
(AD-A072838; TR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05/8

A framework is presented for quantifying and modeling the occurance of human error events in a system. Decision tasks are classified according to the stochastic behavior of the relevant variables associated with the man-machine linkages. A general semi-Markov formulation is presented for describing transitions among error states. Closed form results for the time-between-errors are given through transform relationships for the case where interdecision times form a renewal process. An approximate time-between-error distribution is given that provides computational ease and compared well with some experimental data obtained from a laboratory human decision-making task. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-12741*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VALIDATION METHODS FOR FAULT-TOLERANT AVIONICS AND CONTROL SYSTEMS, WORKING GROUP MEETING 1
Washington Dec. 1979 112 p refs Workshop held at Hampton, Va., 12-14 Mar. 1979
(NASA-CP-2114; L-13436) Avail: NTIS HC A06/MF A01 CSCL 12A

The proceedings of the first working group meeting on validation methods for fault tolerant computer design are presented. The state of the art in fault tolerant computer validation was examined in order to provide a framework for future discussions concerning research issues for the validation of fault tolerant avionics and flight control systems. The development of positions concerning critical aspects of the validation process are given. R.C.T.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N80-12742 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MULTIPROCESSOR ARCHITECTURES FOR SUPPORTING SECURE DATABASE MANAGEMENT Ph.D. Thesis
Robert Parker Trueblood 1979 194 p
Avail: Univ. Microfilms Order No. 7924148

A multiprocessor system supporting secure authorization with full enforcement (MULTISAFE) for database management is presented. The architecture of MULTISAFE combines the concepts of multiprocessing, pipelining, and parallelism to form a system organization partitioned into three modules: The user and application module (UAM), the data storage and retrieval module (SRM), and the protection and security module (PSM). Security is improved because it is physically impossible for a user to access the PSM or the SRM memories. The flow of messages in MULTISAFE is discussed and it is shown that this flow is secure. Abstract data operations on the data object message are used to describe the monitoring procedure for each module. Dissert. Abstr.

N80-12743 Carnegie-Mellon Univ., Pittsburgh, Pa.
BUILDING AND EXPLOITING USER MODELS Ph.D. Thesis
Elaine Alice Rich 1979 217 p
Avail: Univ. Microfilms Order No. 7925024

Stereotypes are proposed as a useful mechanism for building models of individual users on the basis of a small amount of information about them. A system, GRUNDY, that builds user

models with the aid of stereotypes, and then exploits those models to suggest novels that people may find interesting, is described. The system's performance is analyzed to provide some insight into the effectiveness of the user models. The techniques developed for GRUNDY are shown to be appropriate for at least two other domains. The tradeoffs involved in designing such a user modeler for an arbitrary system and the issues involved in the modification of the data base of stereotypes to better describe the system's actual users are discussed. Some questions raised by the ability to model individual users are raised.Dissert. Abstr.

N80-12744 Carnegie-Mellon Univ., Pittsburgh, Pa.
COMPILING CUSTOMIZED EXECUTABLE REPRESENTATIONS AND INTERPRETERS Ph.D. Thesis
Steven Ernest Saunders 1979 91 p
Avail: Univ. Microfilms Order No. 7925025

Issues in the design of executable representation (DELs) for programs are discussed and a compiler implementation which embodies responses to these issues is presented. Methods of tailoring a DEL to fit a chosen combination of host machine and source language, and customizing a tailored DEL to the needs and properties of particular source programs are emphasized. The experimental compiler implementation incorporates several customizing methods, including a tree pattern search for specialized instruction synthesis. The measured performance of the implementation gives promise that the methods presented will be of value. Dissert. Abstr.

N80-12745*# Harris Corp., Melbourne, Fla. Electro-Optics Dept.
OPTICAL MASS MEMORY INVESTIGATIONS. VOLUME 3: CONSIDERATIONS FOR THE DEVELOPMENT OF A DIGIMEM ARCHIVAL OPTICAL MASS STORAGE SYSTEM Final Technical Report, 14 May 1976 - 29 Jun. 1977
R. G. Zech, ed. Jun. 1977 89 p
(Contract NAS8-30564)
(NASA-CR-162460) Avail: NTIS HC A05/MF A01 CSCL 09B

Basic considerations relevant to the implementation of an archival mass storage system based on DIGIMEM technology are discussed in terms of evolving a new generation of mass storage systems which are archival, and cost effective. F.O.S.

N80-12746*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AUTOMATIC DATA PROCESSING EQUIPMENT (ADPE) ACQUISITION PLAN FOR THE MEDICAL SCIENCES
Aug. 1979 35 p
(JSC-16075) Avail: NTIS HC A03/MF A01 CSCL 09B

An effective mechanism for meeting the SLSD/MSD data handling/processing requirements for Shuttle is discussed. The ability to meet these requirements depends upon the availability of a general purpose high speed digital computer system. This system is expected to implement those data base management and processing functions required across all SLSD/MSD programs during training, laboratory operations/analysis, simulations, mission operations, and post mission analysis/reporting. M.M.M.

N80-12747# Mitre Corp., Bedford, Mass.
ERROR CORRECTION CODING WITH NMOS MICROPROCESSORS. VOLUME 1: CONCEPTS
Eric N. Skoog May 1979 105 p refs
(Contract F19628-78-C-0001)
(AD-A072982; MTR-3618-Vol-1; ESD-TR-79-125-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

Error correction coding can be employed in the design of C3 systems to increase transmission reliability and enhance system effectiveness. The maturation of LSI technology and particularly the ubiquitous microprocessor now allow low-cost simple implementations of error coding hardware. Theoretical fundamentals of linear block codes are reviewed with respect to their suitability to decoder design utilizing 8-bit NMOS microprocessors. Key architectural features of NMOS microprocessors are analyzed to determine those characteristics that are best suited to performing decoding functions. A methodology for evaluating MIL-qualified candidate microprocessors is presented that leads to the selection of a microprocessor for the design of the decoder hardware. GRA

N80-12748# Mitre Corp., Bedford, Mass.
ERROR CORRECTION CODING WITH NMOS MICROPROCESSORS, VOLUME 2: A 6800-BASED 7, 3 REED-SOLOMON DECODER
J. R. Hamalainen and Eric N. Skoog May 1979 61 p refs
(Contract F19628-78-C-0001)
(AD-A073088; MTR-3618-Vol-2; ESD-TR-79-125-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

Design, operation and testing of a table-look-up microprocessor-based (Motorola MC6800) (7,3) Reed-Solomon decoder is presented. Decoder operation is fully illustrated by the use of error and erasure pattern examples. Exhaustive (complete) and random (Monte Carlo) testing is employed to exercise the decoder. Test results are analyzed and conclusions drawn relative to decoder performance. GRA

N80-12749# RDP, Inc., Waltham, Mass.
ATMOSPHERE EXPLORER MESA ACCELEROMETER DENSITY DATA BASE Final Report, 16 Mar. 1976 - 14 Jun. 1978
Robert W. Fioretti and Lawrence D. Cox 15 Jun. 1978 35 p refs
(Contract F19628-76-C-0169; AF Proj. 6690)
(AD-A072851; AFGL-TR-79-0062) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the development of an extensive neutral atmospheric density data base generated from MESA accelerometer experiments. This data base represents the most extensive set of neutral density measurements in existence. Studies by AFGL scientists utilizing this data base are in preparation. GRA

N80-12750# Electronics Engineering Group (1842nd), Scott AFB, Ill.
LINE ACCESS TEST SYSTEM (LATS) Final Report
Mike Verstegen and John McCormack 15 Jul. 1979 26 p
(AD-A072768; Rept-1842-EEG/EETE/TR-79-12) Avail: NTIS HC A03/MF A01 CSCL 09/2

This technical report discusses the Line Access Test System (LATS) which can perform matrix switching operations on four wire circuits. Each circuit accessed may be tested for d.c. voltage, resistance, a.c. voltage and capacitance. A microprocessor control implementation is also included with the necessary programs for operation. GRA

N80-12751# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RECENT AUTOMATION CHANGES IN MODEL VELOCITY ANALYSES AND DATA ACQUISITION BY MINIATURE PRICE METERS Final Report, Jul. 1974 - Jul. 1975
Donald L. Durham, Homer C. Grear, III, and Kent A. Turner May 1979 69 p refs
(AD-A072692; WES-HL-MP-79-6) Avail: NTIS HC A04/MF A01 CSCL 09/2

Recent automation of acquisition and analysis of velocity data collected by Price meters is presented in this report. Recent improvements to the fiber optic elements for the Price meter and development of electronic/binary counting circuits are discussed. A general description of a portable digital recording system and detailed documentation of its operating procedures are presented. In addition, documentation is provided for (a) the format of the output magnetic tape generated by the portable digital recording system, and (b) computer (H635) programs for reading and demultiplexing data on magnetic tape, editing and scaling velocity data, and reducing velocity data to a standard format for use in analysis programs and technical reports. GRA

N80-12752# California Univ., Berkeley. Lawrence Berkeley Lab.
DIRECTIONS FOR MEMORY HIERARCHIES AND THEIR COMPONENTS: RESEARCH AND DEVELOPMENT
A. J. Smith Oct. 1978 8 p refs
(Contract W-7405-eng-48)
(LBL-8276) Avail: NTIS HC A02/MF A01

The levels of a computer system memory hierarchy are considered and the state of the art and likely directions for research and development are described. Algorithmic and logical features of the hierarchy not directly associated with specific components are also discussed. The most significant problems

are the following: (1) evaluating the effectiveness of gap filler technology as a level of storage between main memory and disk and determining how/where it should be used; (2) developing algorithms for the use of mass storage in a large computer system; and (3) determining how cache memories should be implemented in very large, fast multiprocessor systems. DOE

N80-12753# Brookhaven National Lab., Upton, N. Y.
LARGE MASS STORAGE FACILITY
A. M. Peskin Aug. 1978 23 p refs
(Contract EY-76-C-02-0016)
(BNL-50900) Avail: NTIS HC A02/MF A01

The programmatic justification for the system presented is reviewed. Several candidate commercial products are identified and discussed. A draft of a procurement specification is developed. Some thoughts on possible new directions for computing at Brookhaven are also offered. DOE

N80-12754# Los Alamos Scientific Lab., N. Mex.
HIGH-SPEED GRAPHICS TERMINAL INTERFACE FOR A PDP-11 MINICOMPUTER
A. E. Spencer May 1979 10 p
(Contract W-7405-eng-36)
(LA-7840-MS) Avail: NTIS HC A02/MF A01

The Asynchronous Line Interface which provides a means of high-speed, asynchronous communications (up to 150 kilobits per second) with 4010 series Tektronix graphics display terminals is described. DOE

N80-12755# European Space Agency, Paris (France).
BACKGROUND STORAGE MANAGEMENT IN OPERATING SYSTEMS FOR COMMUNICATIONS COMPUTERS M.S. Thesis - Tech. Univ., Munich
Michail Melnikow May 1979 85 p refs Transl. into ENGLISH of 'Hintergrundspeicherverwaltung in Betriebssystemen fuer Kommunikationsrechner', DFVLR, Oberpfaffhofen Report DLR-FB-77-37, Aug. 22, 1977 Original report in German announced as N78-31821 Original German report available from DFVLR, Cologne DM 30,20
(ESA-TT-500; DLR-FB-77-37) Avail: NTIS HC A05/MF A01

A background storage management system adapted to the special purposes of communication computers is developed. The architecture of the background storage management system is described by a model consisting of three parts: storage management, data management, and data access methods. The file concept was investigated and formulated with respect to the organization of data on background storage. Using these basic ideas the structures and strategies of the various components of the model are demonstrated. The storage management system (PLADAT implemented on the communication computer TR86) is described in detail. Author (ESA)

N80-12756# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
IMS 11: AN INFORMATION ON MANAGEMENT SYSTEM FOR THE PDP 11 COMPUTER Final Report
Nathan J. Ray Jun. 1979 111 p
(PB-298731/1: GSA/FPA/MCL-TM-274) Avail: NTIS HC A06/MF A01 CSCL 09B

The IMS 11 system, which facilitates the manipulation of data files on the PDP 11 series computing equipment, is described. The system features a query language based on a keyword concept and a random access technique that allows for rapid on-line updating as well as retrieving of data. The system is conversional in nature and is designed to service many users simultaneously while operating under control of the STAMOS time sharing system. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-12757 Johns Hopkins Univ., Baltimore, Md.
MATCHING ALGORITHMS Ph.D. Thesis
Alfred Burton Marsh 1979 220 p
Avail: Univ. Microfilms Order No. 7924824

An algorithm for finding an optimum weight perfect matching in a graph is described. A perfect matching is at hand throughout the algorithm, and a feasible solution to the dual problem is obtained only at termination. In many other respects, including its efficiency, it is similar to the blossom algorithm. Some advantages of this 'primal' algorithm for certain post-optimality problems are presented. An efficient algorithm for finding a set of 'K-best' matchings is developed based upon an assignment ranking scheme of Murty. An algorithm for optimum b-matching is given, whose computation bound depends logarithmically rather than linearly on the b's. The method uses the scaling approach introduced by Edmonds and Karp and a post-optimality method due to Pulley-blank. Some computational experience based upon a computer implementation of the blossom and primal algorithms (for weighted 1-matching) is reported. Dissert. Abstr.

N80-12758 Wisconsin Univ. - Madison.
SET EVALUATION Ph.D. Thesis
David Alan Gustafson 1979 156 p
Avail: Univ. Microfilms Order No. 7918895

An algorithm is presented that performs set evaluation on functions specified in a low level functional specification language. The algorithm is shown to always produce correct set evaluation results. The complexity of the algorithm is analyzed and shown to be polynomial bounded. The algorithm is compared with symbolic execution and program testing in terms of verifying range assertions and shown to be a computationally efficient, alternative method of validating software.
Dissert. Abstr.

N80-12759 Iowa Univ., Iowa City.
LANGUAGE RECOGNITION AND THE SYNCHRONIZATION OF CELLULAR AUTOMATA Ph.D. Thesis
Steven Roland Seidel 1979 336 p
Avail: Univ. Microfilms Order No. 7924527

The language-theoretic properties of three types of one dimensional cellular automata are compared and a link is established between a particular language recognition problem and the firing squad synchronization problem (FSSP). It is shown that the real time unilateral cellular acceptor (UCA) languages are incomparable to the real time serial input cellular acceptor (SCA) languages and properly contained within the real time bilateral cellular acceptor (BCA) languages. As an indication of the complexity of these automata it is shown that the empty intersection, emptiness, containment, and equality problems are undecidable for all the associated families of languages, all contain a non-Parikh-linear language, and while all are closed under inverse homomorphism, none are closed under homomorphism. It is also shown that there is an algorithm that transforms an arbitrary bilateral cellular space to a UCA that recognizes a language in real time if and only if the cellular space is an optimal solution to the FSSP. This should lead to a better understanding of the nature of parallel computation.
Dissert. Abstr.

N80-12760 Columbia Univ., New York.
QUALITY CONSIDERATIONS IN A PROGRAMMING LANGUAGE Ph.D. Thesis
Theodore Eric Mankovich 1979 372 p
Avail: Univ. Microfilms Order No. 7924938

Aspects of computer languages are examined using quality as a guiding point in order to identify problem areas in language design and usage. A new language, Q, is defined which contains a robust data declaration structure for allowing full control of data communication between modules. The selection mechanism is expanded and unified to provide a thorough treatment of this important group of mechanisms. In addition, several meta programming techniques such as coroutines and state tables are explored. These techniques of usage expand the concept of quality programming beyond the definition and use of language constructs. The proper approach to these methodologies is as important to quality as having the proper syntactic tools.
Dissert. Abstr.

N80-12761 Columbia Univ., New York.
THE DESIGN AND ANALYSIS OF A PARALLEL PROCESSING LANGUAGE Ph.D. Thesis

Nadim Robert Habra 1979 323 p
Avail: Univ. Microfilms Order No. 7924898

A high level language for parallel processing, HOPTRAN, is described as a parallel extension to FORTRAN 4. Implementation and code generation are discussed in detail. HOPTRAN is used and analyzed in four application problems and the simulated HOPTRAN program executions are compared against the scalar counterparts. Speedup, efficiency, and occupancy are used as indices of parallel processing efficiency. Dissert. Abstr.

N80-12762 California Univ., Los Angeles.
DESIGN AND MEASUREMENT OF IMPLEMENTATION SCHEMES FOR RETENTION STORAGE MANAGEMENT AS UTILIZED IN BLOCK STRUCTURED LANGUAGES Ph.D. Thesis
Michael Anthony Erlinger 1979 435 p
Avail: Univ. Microfilms Order No. 7926033

Problems in implementing block structured languages containing pointer, procedure, and label variables are discussed and a generalized model, the GMML, capable of retention or deletion storage management is presented. A lifetime stack machine (LSM) GMML utilizing deletion storage management and a partial reference count contour model (PRCCM) GMML utilizing retention storage management are designed and compared for the execution of a lifetime well-stacking (LWS) benchmark. For a large subset of the lifetime well-stacking programs, the PRCCM is shown to have large overhead dedicated to storage management. Another machine model, the partial reference count stack contour model, is then designed and demonstrated to be a much more efficient machine for the execution of LWS programs than the PRCCM and to more closely approach the LSM performance for such programs. Dissert. Abstr.

N80-12763 Yale Univ., New Haven, Conn.
SKIMMING STORIES IN REAL TIME: AN EXPERIMENT IN INTEGRATED UNDERSTANDING Ph.D. Thesis
Gerald Francis Dejong, II 1979 348 p
Avail: Univ. Microfilms Order No. 7925621

The process of interpreting input text words is shown to be greatly simplified if it is viewed as one component of a highly integrated understanding process. A computer program called FRUMP (Fast Reading Understanding and Memory Program) demonstrates how this integration can be accomplished. The program works on a broad domain of inputs which are not required to follow a constraining grammar. In FRUMP the text analyzer is embedded in a predictive understander. All of the world knowledge and top down predictions of the understander are available to the text analyzer. A data construct called a sketchy script is used to store world knowledge. FRUMP continually jumps to conclusions about what the text means and generates predictions about what might occur next. The text analysis process is reduced to finding a reading of the text that satisfies these predictions. The problem of script selection is addressed and a general solution for FRUMP's purposes is given. Dissert. Abstr.

N80-12764 Yale Univ., New Haven, Conn.
SUBJECTIVE UNDERSTANDING: COMPUTER MODELS OF BELIEF SYSTEMS Ph.D. Thesis
Jaime Guillermo Carbonell 1979 467 p
Avail: Univ. Microfilms Order No. 7925636

A process model embodying a theory of subjective understanding was implemented in a computer system, POLITICS. POLITICS models human ideological reasoning in understanding the natural language text of international political events and demonstates its understanding by answering questions in natural language question-answer dialogs. Political ideologies are represented by POLITICS as goal trees that structure the motivations of political actors and the relative importance of the various motivations. Counterplanning strategies determine when, how, and why political actors attempt various plans to thwart each other's goals, nullify each other's thwarting attempts, or end mutual hostilities. The subjective goal trees determine the focus of attention for the reasoning process. The theory of subjective understanding was embodied in other process models in addition to POLITICS and implemented as computer programs. These programs are TRIAD, a system that models human understanding of social conflict situations, and MICS, a system that models a participant in a natural language conversation. Dissert. Abstr.

N80-12765*# M&S Computing, Inc., Huntsville, Ala.
RESEARCH STUDY: DEVICE TECHNOLOGY STAR ROUTER USER'S GUIDE
R. A. Wright 27 Feb. 1979 49 p
(Contract NAS8-32632)
(NASA-CR-161213) Avail: NTIS HC A03/MF A01 CSCL 09B

The STAR Router program developed to perform automated layout of LSI discretionary interconnection masks is described. The input and output for the router are standard PR2D data files. A state-of-the-art cellular path-finding procedure, based on Lee's algorithm, which produces fast, shortest distance routing of microcircuit net data is included. J.M.S.

N80-12766*# Intermetrics, Inc., Long Beach, Calif.
PROGRAMMING IN HAL/S
Michael J. Ryer Sep. 1979 341 p For first edition see N79-14808
(Contract NAS9-13864)
(NASA-CR-162501) Avail: NTIS HC A15/MF A01 CSCL 09B

Intended as an introduction to programming in HAL/S, this manual is organized as a tutorial aid which may be used as part of a self-study program or in conjunction with a course of twenty to forty classroom hours over a period of one to two weeks. A number of corrections to the first edition are incorporated into the text along with a chapter on FIXED data and an additional appendix on FORMAT I/O. A.R.H.

N80-12767# George Washington Univ., Washington, D. C. Program in Logistics.
A SEPARABLE PROGRAMMING APPROACH TO THE LINEAR COMPLEMENTARITY PROBLEM
Jonathan F. Bard and James E. Falk 22 Jun. 1979 19 p refs
(Contract N00014-75-C-0729)
(AD-A072928; Serial-T-403) Avail: NTIS HC A02/MF A01 CSCL 12/1

The linear complementarity problem (LCP) is reformulated as a nonconvex, separable program and solved with a general branch and bound algorithm. Unlike the principal alternatives, the approach offered here works for all linear complementarity problems regardless of their underlying matrix structure. In the reformulated version, the optimal value is known at the outset so a convergence check can be made at each iteration of the algorithm. This greatly increases its performance; in fact, a number of cases are given where immediate convergence can be expected. GRA

N80-12768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A PARAMETRIC MANAGEMENT TOOL FOR ESTIMATING SIMULATOR SOFTWARE SIZE M.S. Thesis
Gregory N. Frey and Kenneth L. Wildung Jun. 1979 201 p refs
(AD-A073015; AFIT-LSSR-4-79A) Avail: NTIS HC A10/MF A01 CSCL 09/2

This research investigated the causes of escalating software costs relative to Aircrew Training Devices (simulators) and resulted in a software sizing tool useful in reversing the cost growth trend. The hypothesis was that a collective software sizing estimate, aggregated and standardized at the functional level, would provide a more reliable estimate of simulator software size. Investigation disclosed that the heuristic sizing techniques being used were inadequate. There was no organized empirical data-base to support a formalized software sizing process. A software management model called SIMSIZ, including a supporting data-base, was designed and developed. The model's primary function is to assist software engineers in making realistic evaluations of the size of contractor's proposed software packages. It was concluded that a major cause of software program delays has been a growth trend in software size during program development. SIMSIZ has demonstrated that several software projects under development are undersized. The researchers

recommend establishing a requirement to standardize simulator software development and reporting at the functional level. GRA

N80-12769# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A COLLECTION OF EQUATION-SOLVING CODES FOR THE CRAY-1
D. A. Calahan, W. G. Ames, and E. J. Sesek 1 Aug. 1979 23 p refs
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A073033; SEL-133; AFOSR-79-0932TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report contains user documentation and timing results for a collection of assembly language equation-solving codes for the CRAY-1. GRA

N80-12770# Harry Diamond Labs., Adelphi, Md.
THE INFINITE PARALLEL-WIRE ARRAY OVER A GROUND PLANE: A CODE FOR AN EMP VULNERABILITY ASSESSMENT AND HARDENING PROGRAM
Michael J. Vrabel Jul. 1979 17 p refs
(AD-A073103; HDL-TM-79-19) Avail: NTIS HC A02/MF A01 CSCL 09/2

Elements of the multiwire parallel array over a ground plane are addressed with a systems-related EMP vulnerability assessment and hardening orientation. An abbreviated computer program supported by experimental data permits a calculation of the degree of interaction of the wires of a parallel array, the individual wire and array impedance to ground, and the relative current distribution among the wires exclusive of wire end loading. This represents the foundation for an inclusive EMP code. GRA

N80-12771# California Univ., Santa Cruz. Information Sciences.
GENERATING CORRECT PROGRAMS FROM LOGIC SPECIFICATIONS Ph.D. Thesis
Ruth Ellen Davis 24 May 1979 201 p
(Contract N00014-76-C-0682)
(AD-A073023; TR-79-5001) Avail: NTIS HC A10/MF A01 CSCL 09/2

We have designed and implemented a system that accepts logic specifications, generates algorithms in an intermediate language, and then translates these algorithms into programs in specific target languages. The specification and intermediate languages are described in detail via their context free grammars and axiomatic semantics. It has been proved that the mappings preserve the axiomatic semantics of the programs. We discuss the system as implemented, the requirements for extending it to new target languages, and further work suggested by the project. GRA

N80-12772# Sandia Labs., Albuquerque, N. Mex.
INPUT AND TABLE-HANDLING FACILITY FOR FORTRAN PROGRAMS
R. E. Jones Mar. 1979 101 p
(Contract EY-76-C-04-0789)
(SAND-78-1165) Avail: NTIS HC A06/MF A01

An input and table handling facility for FORTRAN programs is described. This facility, when incorporated into a FORTRAN program, allows input to FORTRAN programs to be prepared in an easy, natural form. It also allows users to input n-dimensional tables in a flexible manner, and allows the FORTRAN program to use these tables easily. Complete details are given on how to incorporate this facility into a program and how to prepare input to be read by this facility. DOE

N80-12773# Engineering Science and Systems Corp., San Diego, Calif.
ASSESSMENT OF PROCEDURES AND PRELIMINARY SOFTWARE DESIGN FOR FAULT TREE SYNTHESIS
H. J. Payne Oct. 1978 72 p refs
(Contract W-7405-eng-48)
(UCRL-13919; ES-R-A007-01) Avail: NTIS HC A04/MF A01

The safeguards effectiveness assessment methodology was applied to the assessment of the material control and accounting (MC and A) systems. A representation of the MC and A system and potential adversary actions is created as a directed network (digraph), and a fault tree is synthesized from the digraph. It is shown that the Lapp-Powers approach to constructing the digraph is not capable of handling the MC and A assessment problem. Software functional specifications are given. DOE

N80-12774# Los Alamos Scientific Lab., N. Mex.
INTERACTIVE USE OF COMPUTER DRAWN FACES TO STUDY MULTIDIMENSIONAL DATA
L. A. Bruckner and C. F. Mills Mar. 1979 39 p
(Contract W-7405-eng-36)
(LA-7752-MS) Avail: NTIS HC A03/MF A01

The code presented, DRFACE, allows the user to view facial representations of data at a graphics terminal and then, by easily made changes, to display new representations of the same data. The user can change the facial feature/data variable assignments, the facial feature ranges, and default values. This ability permits the user to determine if observations made about the data from viewing the first set of faces are due to chance assignments or actually reflect patterns in the data. DOE

N80-12775# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
UNIVERSAL P-CODE DEFINITION, VERSION (0.3)
Richard L. Sites and Daniel R. Perkins Jul. 1979 45 p Sponsored in part by LASL and LLL
(PB-298577/8; UCSD/CS-79/037) Avail: NTIS HC A03/MF A01 CSCL 09B

Universal P-code (U-code), version (0.3) is officially defined as a language independent of U-code processors. The U-code is a compiler intermediate language into which many existing Pascal P-codes can be mapped. Processors exist to map Pascal and FORTRAN into U-code, and to map Cray-1 P-code into U-code. In turn, processors exist to map Pascal and Model into Cray-1 P-code. Translators also exist to map U-code into Cray-1 P-code and into S-1 machine language. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also 54 Man/System Technology and Life Support.

N80-12776*# American Mathematical Society, Providence, R.I.
SYSTEM THEORY AS APPLIED DIFFERENTIAL GEOMETRY
Robert Hermann Nov. 1979 67 p refs
(Grant NSG-2252)
(NASA-CR-3209) Avail: NTIS HC A04/MF A01 CSCL 09B

The invariants of input-output systems under the action of the feedback group was examined. The approach used the theory of Lie groups and concepts of modern differential geometry, and illustrated how the latter provides a basis for the discussion of the analytic structure of systems. Finite dimensional linear systems in a single independent variable are considered. Lessons of more general situations (e.g., distributed parameter and multidimensional systems) which are increasingly encountered as technology advances are presented. R.C.T.

N80-12777# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
DESIGN AND PERFORMANCE EVALUATION FOR SYSTEMS IN AN UNCERTAIN ENVIRONMENT Final Report, 1 Mar. 1976 - 30 Jun. 1979
Ian B. Rhodes 23 Aug. 1979 174 p refs
(Contract N00014-76-C-0667)
(AD-A073207) Avail: NTIS HC A08/MF A01 CSCL 12/2

Included in this report are results of investigations into the

following topics: design and performance evaluation of optimal and suboptimal estimation and tracking systems for space-time point-process observations; optimal signal design for coded, direct-detection optimal communication systems; informationally-decentralized shortest path algorithms for networks; singular estimation and control problems; compensator design for polynomial matrix descriptions of linear multivariable systems; a direct proof of the informational equivalence of the innovations and observations processes for linear estimation or Gaussian processes; and quantitative measures of controllability and observability and their implications in system analysis and performance evaluation. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-12778 Princeton Univ., N. J.
FINITE GROUP ACTIONS ON SIMPLY-CONNECTED MANIFOLDS AND CW COMPLEXES Ph.D. Thesis
Amir Hossein Assadi 1979 85 p
Avail: Univ. Microfilms Order No. 7918548

The existence and construction of embeddings of a given G-CW complex (G-manifold) in another G-CW complex (G-manifold) having a prescribed homotopy type and a prescribed family of isotropy sub-groups are discussed. It is shown that for the case of compact complexes, obstructions can be specified as lying in the quotient of Grothendick groups of certain categories of equivariant complexes. In the non-compact case, the embedding is possible under favorable hypotheses. Topological and PL actions of finite groups on spheres leaving any finite simplicial complex stationary are demonstrated. Classification of concordance classes of actions and construction of equivariant embeddings are discussed. Dissert. Abstr.

N80-12779 Michigan Univ., Ann Arbor.
LINEAR EXTREMAL PROBLEMS IN THE CLASS OF UNIVALENT FUNCTIONS Ph.D. Thesis
Johnny Earl Brown 1979 84 p
Avail: Univ. Microfilms Order No. 7925118

Using variational techniques in the class S, the support points were investigated for the point-evaluation functionals phi (g) = g (z sub zero) and the functionals phi (g) = (a sub 3 + lambda a sub 2). The problem max Re g(z) sub zero, g epsilon S was solved completely. The support points corresponding to the point-evaluation functionals are determined explicitly and are shown to be extreme points of S. Applying some of the same techniques, similar geometric properties were obtained of the omitted arcs of the support points for phi (g) = (a sub 3 + lambda a sub 2). These omitted arcs lie in sectors and have monotonic arguments. Dissert. Abstr.

N80-12780 North Carolina Univ. at Chapel Hill.
SOME ASPECTS OF THE LOCAL AND GLOBAL THEORY OF PFAFFIAN SYSTEMS Ph.D. Thesis
Robert Leamon Bryant 1979 54 p
Avail: Univ. Microfilms Order No. 7925892

Smooth sub-bundles of the cotangent bundle of a smooth manifold which do not necessarily satisfy the conditions of complete integrability are considered. The structure tensor associated to the sub-bundle which measures the amount of deviation from complete integrability is exploited in order to prove local structure theorems about these sub-bundles. In particular, it is shown that a sub-bundle is locally equivalent to the bundle of contact forms on J(1)(R(m),R(n)) if its structure tensor satisfies certain mild restrictions. Vanishing theorems analogous to that of Bott for the integrable case are considered and it is proved that there are relations among the exotic classes for these bundles and their derived bundles. Dissert. Abstr.

N80-12781 New York Univ., N. Y.
HIGH-ORDER ACCURATE SOLUTION OF LAPLACE'S EQUATION ON GENERAL REGIONS USING INTEGRAL EQUATION METHODS AND FAST POISSON SOLVERS Ph.D. Thesis
Anita Alberta Mayo 1979 55 p
Avail: Univ. Microfilms Order No. 7925494

Fast methods are developed for the numerical solution of a variety of elliptic partial differential equations on arbitrary irregular regions. The methods use an integral equation formulation in a small carefully chosen region near the boundary, and use fast solvers to extend the solution to the rest of the region. Error estimates are obtained and numerical results are shown to agree with those estimates. The techniques work well for both Neumann and Dirichlet data, and for problems on interior, multiconnected, and exterior regions, as well as for regions with interior corners. Moreover, the computation of fourth order solutions is only slightly more expensive than those of second order. Since integral equations are used, the conjugate of a harmonic function can be computed at small additional cost. This proves useful in the application of our methods to problems in conformal mapping. The techniques are also applied to a problem in elasticity. Dissert. Abstr.

N80-12782*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
MODULAR THEORY OF INVERSE SYSTEMS Final Report, 1 Jun. - 31 Dec. 1979
Dec. 1979 57 p refs Submitted for publication
(Grant NsG-2388)
(NASA-CR-162491) Avail: NTIS HC A04/MF A01 CSCL 12A

The relationship between multivariable zeros and inverse systems was explored. A definition of zero module is given in such a way that it is basis independent. The existence of essential right and left inverses were established. The way in which the abstract zero module captured previous definitions of multivariable zeros is explained and examples are presented. R.C.T.

N80-12783# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
COVARIANCE SEQUENCE APPROXIMATION WITH APPLICATIONS TO SPECTRUM ANALYSIS AND DIGITAL FILTER DESIGN
A. A. Beex and L. L. Scharf Jul. 1979 150 p refs
(Contract N00014-75-C-0518)
(AD-A072884; CSU-TR-26(ONR)) Avail: NTIS HC A07/MF A01 CSCL 12/1

Modeling and estimation procedures for covariance sequence and spectrum approximation are developed in this thesis. The covariance sequence is modeled as a complex linear combination of damped complex exponentials. This model arises naturally as the representation for the covariance sequence associated with a strictly proper ARMA(M,N) system driven by white noise. Related to this seemingly natural covariance model is a synthesis procedure for a subclass of wide sense stationary ARMA(M,N) processes. The resulting spectral representation for the covariance sequence is a positive real linear combination of damped complex exponentials, a generalization of the standard representation in terms of stochastic almost periodic functions. The importance of the generalized structure lies in the more efficient representation of a large class of wide sense stationary processes. For this parametric approach estimation techniques are developed that lie in philosophy somewhere between the nonlinear least squares approach and the tractable modified least squares procedure. The resulting parameter estimation equations are linear, except for a single polynominal rootfinding problem that must be solved. GRA

N80-12784# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ON THE EXISTENCE OF SIMPLE LIAPUNOV FUNCTIONS FOR LINEAR RETARDED DIFFERENCE DIFFERENTIAL EQUATIONS Interim Report
L. A. V. Carvalho, E. F. Infante, and J. A. Walker Jul. 1979 35 p refs Prepared in cooperation with Universidade Federal de Goias, Goiania, Brazil and Northwestern University, Evanston, Ill.
(Contract N00014-76-C-0278; AF-AFOSR-3092-76; Grants NSF eng-76-81570; NSF MCS-78-18858; ARO-D-31-124-73-G130; AF Proj. 2304)
(AD-A072762; AFOSR-79-0920TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Liapunov functions of simple form have been used for the study of stability properties of difference-differential equations. In this paper, we provide necessary and sufficient conditions for the existence of such functions. GRA

N80-12785# Brown Univ., Providence, R. I. Center for Dynamical Systems.
SPLINE APPROXIMATIONS FOR FUNCTIONAL DIFFERENTIAL EQUATIONS Interim Report
H. T. Banks and F. Kappel (Graz Univ.) Aug. 1978 53 p refs
(Grants AF-AFOSR-3092-76; NSF GP-28931; AF Proj. 2304)
(AD-A072763; AFOSR-78-1442TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

An approximation framework is developed for linear hereditary systems which includes as special cases approximation schemes employing splines of arbitrary order. Numerical results for first and third order spline based methods are presented and compared with results obtained using a previously developed scheme based on averaging ideas. GRA

N80-12786# Colorado State Univ., Fort Collins. Dept. of Mathematics.
UNIFORM APPROXIMATION BY RATIONAL FUNCTIONS HAVING RESTRICTED DENOMINATORS Interim Report
G. D. Taylor and E. H. Raufman, Jr. (Central Michigan Univ.) 1979 24 p refs
(Grants AF-AFOSR-2878-76; NSF MCS-78-05847; AF Proj. 2304)
(AD-A072835; AFOSR-79-0897TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper considers approximation of continuous functions on a compact metric space by generalized rational functions for which the denominators have bounded coefficients and are bounded below by a fixed positive function. This lower bound alleviates numerical difficulties, and in some applications (e.g., digital filter design) has a useful physical interpretation. A zero in the convex hull characterization of best approximations is developed and used to prove uniqueness and de la Vallee Poussin results. Examples are given to illustrate this theory and its differences with the standard theory, where the denominators are merely required to be positive. A modified differential correction algorithm is presented and is proved to always converge at least linearly, and often quadratically. GRA

N80-12787# SRI International Corp., Menlo Park, Calif.
TWO-DIMENSIONAL MESH ADJUSTMENT ALGORITHM Annual Report, 1 Jun. 1978 - 31 May 1979
C. M. Ablow and S. Schecter 31 Jul. 1979 8 p refs
(Contract F49620-77-C-0114; AF Proj. 2304)
(AD-A073060; AFOSR-79-0938TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This second year of research effort has produced a mesh adjustment algorithm for the solution of one-dimensional boundary-value problems based on an arbitrarily given monitor function. A second, more complex algorithm simultaneously finds the solution and the optimal monitor to minimize the truncation error. The results provide an immediately applicable technique for the solution of stiff differential systems such as arise in reactive duct flow problems, as well as a firm basis for the extension to the higher dimensional problems of viscous duct flow or external lifting flows. GRA

N80-12788# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPECTRAL ANALYSIS OF TIME SERIES M.S. Thesis
Anthony L. Bertapelle Mar. 1979 60 p refs
(AD-A072921; AFIT/GST/MA/79M-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

One use of spectral analysis of time series is to determine if two different time series are realizations from the same process. This thesis develops the theory behind Krishnaiah and Schuurmann's theoretical work reported in their report Approximations to the Distributions of the Traces of Complex Multivariate Beta and F Matrices. We take the trace of a test statistic calculated from the spectral density matrices of the time series and test it. The thesis applies the theory to two small sample simulations. GRA

N80-12789# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ON THE RELATIONSHIP BETWEEN THE R AND S ARRAYS AND THE BOX-JENKINS METHOD OF ARMA MODEL IDENTIFICATION
Wayne A. Woodward and H. L. Gray 25 Jul. 1979 39 p refs
(Contract N00014-75-C-0439; NR Proj. 042-280)
(AD-A072934; TR-134) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper an extension of the partial autocorrelation function which we call the generalized partial autocorrelation function is investigated. This generalized partial autocorrelation function is useful in examining the relationship between the R- and S-array method of Gray, Kelley, and McIntire and the Box-Jenkins approach to ARMA model identification. Also the generalized partial autocorrelation is shown to be a useful model identification tool to be used along with the R- and S-arrays. Also discussed is a reformatting of the S-array into the shifted S-array which the authors believe to be easier to use in practice than the S-array. The methods of this paper are illustrated by means of examples including an analysis of the Mskridakis metals series data. GRA

N80-12790# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A CONDITIONAL PROPERTY OF ADAPTIVE ESTIMATORS
William C. Parr 25 Jul. 1979 15 p refs
(Contract N00014-75-C-0439)
(AD-A072991; TR-133) Avail: NTIS HC A02/MF A01 CSCL 12/1

In adaptive estimation, it is often considered that an estimator has made a mistake if the component estimator chosen for use is not the most efficient for the distribution sampled. Theoretical and simulation results point to a fallacy in this line of thought. The Monte Carlo study involves extension of the Princeton Swindle to distributions conditional on a location-and scale free statistic, and to the uniform. The results give a partial explanation for the sometimes surprising robustness of adaptive L-estimators. GRA

N80-12791# Pittsburgh Univ., Pa. Inst. for Computational Mathematics and Applications.
INVERSION OF ISOPARAMETRIC MAPPINGS AND APPLICATIONS OF COMPUTER GRAPHICS TO THREE DIMENSIONAL FINITE ELEMENT ANALYSES Final Report
Charles A. Hall and Thomas A. Porsching Jul. 1979 33 p refs
(Contract F44620-76-C-0104)
(AD-A073013; ICMA-79-08; AF-79-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite element analyses of two and three dimensional structures often require the use of curved isoparametric elements. The overall effectiveness of such analyses by large scale finite element computer programs is often handicapped by the costly and tedious job of verifying input data and the lack of a comprehensive graphical presentation of the output. This contract work involved mathematical research concerning various approaches to improving this pre and post processing of finite element data utilizing interactive computer graphics. A key aspect of this work was the characterization of the existence of the inverses of isoparametric mappings, as well as the development of efficient algorithms for the numerical inversion of such mappings. GRA

N80-12792# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
ON THE SOLUTION OF A CERTAIN LINEAR LEAST SQUARES FIT PROBLEM Interim Report, Jul. 1978 - Apr. 1979
Donald A. Gignac Jun. 1979 27 p refs
(SR0140301; ZF53532001)
(AD-A072689; DTNSRDC/CMLD-79/07) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report investigates the difficulties encountered with respect to a certain linear least squares fit problem which arises in the field of holographic interferometry. It was found that the addition of another variable to the equations of this linear least

squares fit problem explained these difficulties and provided consistent results. This report also demonstrates the usefulness of Stewart's recently published perturbation bounds for the purpose of error bounding. GRA

N80-12793# Maryland Univ., College Park. Inst. for Physical Science and Technology.
DIRECT AND INVERSE ERROR ESTIMATES FOR FINITE ELEMENTS WITH MESH REFINEMENTS
I. Babuska, R. B. Kellogg, and J. Pitkaeranta Apr. 1979 45 p refs
(Contract EY-76-S-05-3443)
(ORO-3443-81; BN-907) Avail: NTIS HC A03/MF A01

The finite element method is used to solve a second order elliptic boundary value problem on a polygonal domain. Mesh refinements and weighted Besov spaces are used to obtain optimal error estimates and inverse theorems. DOE

N80-12794# Los Alamos Scientific Lab., N. Mex.
BLOCK RELAXATION TECHNIQUES FOR FINITE-ELEMENT ELLIPTIC EQUATIONS: AN EXAMPLE
D. L. Boley and S. V. Parter Jun. 1979 19 p refs
(Contract W-7405-eng-36)
(LA-7870-MS) Avail: NTIS HC A02/MF A01

The Ritz-Galerkin equations for the numerical solution of the two-point boundary value problem, u double prime = f, o < or = x < or = 1, u(o) = u(1) = 0, are considered. Ritz-Galerkin subspaces of hermite cubic splines with equally spaced knots are examined. These equations are then solved via iterative methods. The rate of convergence of these methods is estimated. DOE

N80-12207 Institut Franco-Allemand de Recherches, St. Louis (France).
THE USE OF HAMILTONIAN QUATERNIONS FOR DETERMINING THE TRANSLATIONAL AND ROTATIONAL MOTION OF A PROJECTILE
V. Flack *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 22-35 refs In GERMAN; ENGLISH summary
(For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-12795 American Univ., Washington, D. C.
ADAPTIVE PROCEDURES IN ANALYSIS OF VARIANCE Ph.D. Thesis
William Clark Rinaman 1979 187 p
Avail: Univ. Microfilms Order No. 7924361

Adaptive procedures are developed for testing main effects in one and two way analysis of variance situations. The adaptive testing procedure consists of selecting tests for use when the population distributions have light, medium, or heavy tail weight, respectively, and using a tail weight detection scheme to select the appropriate test. The asymptotic properties of Kruskal-Wallis like statistics based on trimmed samples are developed for the one way case. FOr the two way situation, Sen's generalization of the Friedman test is further generalized to the case of more than one observation per cell. In addition, for the case where the number of observations per cell is large compared to the number of blocks, the trimmed sample tests already developed are adapted for use in the two way case. Computer simulations are used to compare the resulting adaptive procedures with the single test statistics for small sample sizes. Dissert. Abstr.

N80-12796 Boston Univ., Mass.
EFFECTS OF CATEGORIZATION ON RELATIONSHIPS IN BIVARIATE DISTRIBUTIONS AND APPLICATIONS TO RATING SCALES Ph.D. Thesis
Lily Neumann 1979 127 p
Avail: Univ. Microfilms Order No. 7923947

The problems of scale length and effects of grouping on relationships among variables were approached both theoretically and practically. Effects of grouping on the correlation coefficient and on proportional reduction in variance were examined for several bivariate distributions: uniform, normal, exponential, and logistic. In general, the change in these measures of association decreased as the number of classification groups increased. The pattern and degree of change were very similar for five, seven, and ten point scales. This fact was also supported by the results of a questionnaire on students' satisfaction with courses, which was designed to compare six rating scales. The longer scales resulted in similar outcomes. A clear preference (by the respondents) was given to scales with a neutral point. Dissert. Abstr.

N80-12797 Johns Hopkins Univ., Baltimore, Md.
MEASURING INTER-RATER RELIABILITY OF DICHOTOMOUS RESPONSES: A COMPONENTS OF VARIANCE APPROACH Ph.D. Thesis
Ellen Jane Mackenzie 1979 132 p
Avail: Univ. Microfilms Order No. 7924622

A multistage modeling of the random variables Y sub ij (of which the ratings of the ith subject by the jth rater are observed values) is presented. The unconditional variation in the Y sub ij is determined and shown to partition into components corresponding to subject and shown to partition into components corresponding to subject and rater effects. Agreement is measured by the intraclass correlation coefficient, defined as the proportion of total variation in ratings which can be explained by differences in subjects. The components of variance model developed for dichotomous data is completely specified within the general two stage framework. Four models are considered: (1) random subject, no rater effects; (2) random subject, random rater effects; (3) random subject, fixed rater effects; and (4) fixed subject, random rater effects. The resulting estimators are interpreted within the context of reliability experiments and are compared with other proposed measures of agreement. Dissert. Abstr.

N80-12798 North Carolina Univ. at Chapel Hill.
TOWARDS RECONSTRUCTION OF AN UN-PAIRED RANDOM SAMPLE Ph.D. Thesis
Donna Jeanne Lucas 1979 115 p
Avail: Univ. Microfilms Order No. 7925942

The probability of occurrence of a sufficient condition for equivalency of the maximum likelihood and optimal solutions when the broken random sample is from a bivariate normal distribution is examined. For the problem of matching one particular observation of the unpaired random sample, a procedure based on the most probable rank of the concomitant of that observation is proposed. The maximum likelihood solution to the matching problem for multivariate normal data when each observation vector is separated into three components is given. Additionally, reconstruction of partially broken random samples is presented in the framework of regression and experimental designs. For the case in which the partially unpaired random sample arises from a bivariate normal distribution, the maximum likelihood estimator of the correlation coefficient is derived. Where X and Y have an absolutely continuous bivariate distribution, the joint distribution is discussed as a tool in examining the consequences of estimation and testing procedures applied to re-paired samples. Dissert. Abstr.

N80-12799 North Carolina Univ. at Chapel Hill.
RANK TESTS FOR RESTRICTED ALTERNATIVE PROBLEMS IN MULTIVARIATE ANALYSIS Ph.D. Thesis
Vernon Michael Chinchilli 1979 182 p
Avail: Univ. Microfilms Order No. 7925899

Restricted alternative hypothesis problems in multivariate analysis are discussed. The tests considered include: (1) the likelihood ratio (LR) statistic for testing the hypothesis that the multivariate normal distribution with known covariance matrix is zero against the hypothesis that it lies in the nonnegative orthant; (2) the LR statistic for restricted alternatives involving the mean of a multivariate distribution whose covariance matrix is not completely specified; and (3) a bivariate linear rank statistic used in conjunction with the union-intersection principle for a bivariate, two sample, restricted location problem and an order restriction problem with randomized blocks. Dissert. Abstr.

N80-12800 North Carolina Univ. at Chapel Hill.
LIMITING BEHAVIORS OF CERTAIN CONTINUOUS TIME-PARAMETER STOCHASTIC PROCESSES AND THEIR APPLICATIONS Ph.D. Thesis
Yi Tsong 1979 138 p
Avail: Univ. Microfilms Order No. 7925975

The asymptotic Wiener process properties of a class of continuous time parameter stochastic processes are obtained. These results are also studied in supnorm topology. Applications of these results arising in life testing under progressive truncation schemes are given. The asymptotic Wiener process properties of the progressively truncated likelihood ratio statistic in Skorokhod topology as well as in supnorm topology are obtained. Limiting distributions of the statistic under a sequence of contiguous alternatives are studied. An extension to the multiparameter case is also studied. These results are applied to the hypothesis testing and parameter estimation in life testing under progressive truncation schemes. Comparisons are made by using Bahadur asymptotic relative efficiencies on the test statistics under progressive truncation schemes and under fixed point truncation schemes. Dissert. Abstr.

N80-12801 California Univ., Riverside.
STATISTICAL INFERENCE IN MARKOV CHAINS USING THE PRINCIPAL OF MINIMUM DISCRIMINATION INFORMATION Ph.D. Thesis
Said Mohamed Rujbani 1979 107 p
Avail: Univ. Microfilms Order No. 7924303

The principal of minimum discrimination information is applied to some Markov models in a manner similar to that applied to contingency tables and in a form suitable for use by applied statisticians. Basic concepts of information theory are introduced, minimum discrimination information estimation is discussed, and analysis of information tables are constructed. Methods are outlined for assessing the order of a chain and transforming higher order chains to lower order ones. Tests of homogeneity, symmetry, and stationarity are presented along with a test of the hypothesis of order t against that of order t prime (t prime < t). An embedded Markov chain is also presented. Examples demonstrating the conceptual simplicity of the information approach are given. Dissert. Abstr.

N80-12802 Iowa Univ., Iowa City.
IMPROVED ESTIMATIONS UNDER RESTRICTED PARAMETERS SPACES Ph.D. Thesis
David Harry Robinson 1979 104 p
Avail: Univ. Microfilms Order No. 7924524

Restrictions placed on the usual parameter space are assumed which reduce the size of the parameter space. Under such an assumption, it seems reasonable that improved estimation should be possible even when $p > 3$. Estimation is considered using two criteria: mean square error and confidence interval coefficients. Shrinkage estimators are examined in both the one dimensional and multidimensional cases. Several choices for the coefficient c are examined, both as a fixed constant and as a random variable. Results derived are presented. Dissert. Abstr.

N80-12803 Oregon State Univ., Corvallis.
ESTIMATION OF THE ORDER OF AN AUTOREGRESSIVE TIME SERIES - A BAYESIAN APPROACH Ph.D. Thesis
Loretta Jean Robb 1979 68 p
Avail: Univ. Microfilms Order No. 7925684

The problem of autoregressive order estimation is placed in a Bayesian framework. This is done with the intent of illustrating how the Bayesian approach brings the numerous aspects of the problem together into a coherent structure which is both complementary to presently used methods and intuitively satisfying. A joint prior probability density is proposed for the order, the partial autocorrelation coefficients and the variance, and the marginal posterior probability distribution for the order, given the data, is obtained. It is noted that the value with maximum posterior probability is the Bayes estimate of the order with respect to a particular loss function. The asymptotic posterior distribution of the order is also given. Sunspot data as well as simulated data corresponding to several autoregressive models are analyzed. Dissert. Abstr.

N80-12804 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A COMPARATIVE STUDY OF NONPARAMETRIC METHODS IN THE RANDOMIZED BLOCK DESIGN UNDER ORDERED ALTERNATIVES Ph.D. Thesis
Barbara Mann Stauffer 1979 224 p
Avail: Univ. Microfilms Order No. 7925384

Several classes of nonparametric tests for ordered treatment alternatives in the randomized block model with one observation per cell are compared. The tests included are within-blocks ranks tests, extensions of paired sample tests, and aligned ranks tests. A normal theory likelihood ratio test is also included for comparative purposes. The Monte Carlo study compares several tests, including at least one from each class, under several combinations of design size, symmetric error distributions, and spacing of alternatives. Both the significance level and the power of the tests are examined. Finally, on the basis of the asymptotic results and the small-sample simulation, some suggestions are made to the potential user of these methods. Dissert. Abstr.

N80-12805*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MAXIMUM LIKELIHOOD ESTIMATION OF LABEL IMPERFECTIONS AND ITS USE IN THE IDENTIFICATION OF MISLABELED PATTERNS
C. B. Chittineni Aug. 1979 44 p
(Contract NAS9-15800)
(NASA-CR-160364; LEC-16067; JSC-16067) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of estimating label imperfections and the use of the estimation in identifying mislabeled patterns is presented. Expressions for the maximum likelihood estimates of classification errors and a priori probabilities are derived from the classification of a set of labeled patterns. Expressions also are given for the asymptotic variances of probability of correct classification and proportions. Simple models are developed for imperfections in the labels and for classification errors and are used in the formulation of a maximum likelihood estimation scheme. Schemes are presented for the identification of mislabeled patterns in terms of threshold on the discriminant functions for both two-class and multiclass cases. Expressions are derived for the probability that the imperfect label identification scheme will result in a wrong decision and are used in computing thresholds. The results of practical applications of these techniques in the processing of remotely sensed multispectral data are presented. R.C.T.

N80-12806# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ONE-SIDED TOLERANCE LIMITS FOR A BROAD CLASS OF LIFETIME DISTRIBUTIONS WITH APPLICATIONS TO DATA OF LIMITED ACCURACY
Wayne A. Woodward and William H. Frawley 25 Jul. 1979 28 p refs Prepared in cooperation with E-Systems, Inc., Greenville, Tex.
(Contract N00014-75-C-0439)
(AD-A072936; TR-135) Avail: NTIS HC A03/MF A01 CSCL 12/1

Addressed is the problem of determining a one-sided tolerance limit for a population possessing a distribution belonging to a broad class of life-time distributions. A new implementation of existing general theory is given and contrasted with an earlier utilization of that theory. General guidelines are given for deciding which implementation to use. A method for adjusting for the accuracy of the measuring device is discussed and illustrated with an actual example. GRA

N80-12807# Illinois Univ. at Urbana-Champaign. Dept. of Computer Science.
BURST PROCESSING Final Report
W. J. Poppelbaum Feb. 1979 32 p refs
(Contract N00014-75-C-0982)
(AD-A072872; UIUCDCS-R-79-957; UILU-ENG-79-1702) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report describes both a quasi-analog and a purely digital fashion of performing arithmetic using bursts; on the way the use of non-compacted bursts and the corresponding encoders is brought up. Then, the general area of digital filters, realized in burst technology, is discussed and practical examples from the area of convolution, adaptive filtering and RF tuning and

demodulation are given. Finally, applications to picture processing and 'spatial' versions of burst processing are mentioned and suggestions made for future areas of study. GRA

N80-12808# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A SPECIAL DISTRIBUTION RESULT FOR BILINEAR FORMS
James Beckett, III, William R. Schucany, and James D. Broffitt 22 Jun. 1979 13 p refs
(Contract N00014-75-C-0439)
(AD-A072933; TR-131) Avail: NTIS HC A02/MF A01 CSCL 12/1

Necessary and sufficient conditions are given such that a quadratic form has a moment generating function. An important corollary gives conditions under which the bilinear form involving two different multivariate normal random vectors (of not necessarily the same dimensions) has the same distribution as the sum of independent random variables, each having the LaPlace (double exponential) distribution. Examples are given and discussed. J.M.S.

N80-12809# Battelle Pacific Northwest Labs., Richland, Wash.
STATISTICAL METHODS FOR EVALUATING SEQUENTIAL MATERIAL BALANCE DATA
M. A. Wincek and K. B. Stewart Apr. 1979 184 p refs
(Contract EY-76-C-06-1830)
(NUREG-CR-0683; PNL-2920) Avail: NTIS HC A08/MF A01

The material balance model is considered where the only modeled variability is that due to the measurements of the net throughput. Models which assume no loss, constant loss, and all-at-once loss situations are examined. Emphasis is placed on explaining state variable model and Kalman filtering in relation to the general linear statistical model to which least squares is applied yielding a minimum variance unbiased estimator. All errors affecting material balances are assumed to be random. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-12810# Yale Univ., New Haven, Conn. Cowles Foundation for Research in Economics.
STOCHASTIC GAMES, OLIGOPOLY THEORY AND COMPETITIVE RESOURCE ALLOCATION
Martin Shubik and Matthew J. Sobel 30 May 1979 19 p refs
(Contract N00014-77-C-0518; NR Proj. 047-006; Grant NSF SOC-78-05770)
(AD-A073030; Discussion Paper-525) Avail: NTIS HC A02/MF A01 CSCL 12/1

We define discrete time sequential games which are multiperson Markov decision processes. The extant theory is sketched and compared with our assessment of research needs in dynamic models of oligopoly and other competitive resource allocation problems. A special class of economic survival games is noted. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-12811 Iowa Univ., Iowa City.
ON RINGS WITH SELF-DUALITY Ph.D. Thesis
Joel Knight Haack 1979 73 p
Avail: Univ. Microfilms Order No. 7924480

It is shown that there is a large class of Nakayama's serial rings that have self duality. Using related methods it is proven that, over division rings, Mitchell's tic tac toe rings (a much larger class of subrings of matrix rings over division rings) have self duality. Associated with each Artinian ring R are two digraphs called the left and right quivers of R. A well known theorem on hereditary serial rings is generalized by proving that if these quivers have no closed paths, then R is a factor ring of a tic tac toe ring and has self duality. Applying this theorem and theorems of Gabriel and Dlab and Ringel, it is shown how one can write explicit matrix representations of all hereditary algebras of finite module type. Dissert. Abstr.

N80-12812 Kansas State Univ., Manhattan.
EXTENSIONS OF FUNCTIONS IN SOBOLEV AND BESOV SPACES Ph.D. Thesis
David William Hutchison 1979 116 p
Avail: Univ. Microfilms Order No. 7925823

Necessary and sufficient conditions were found for the existence of an extension of a function defined on a polyhedral set contained in R sup n to a function defined on all of R sup n and which is in either the Sobolev space (possibly of fractional order) or the Besov space (with two parameters) defined on R sup n with a given order of smoothness. The problem has applications in the area of boundary value problems in partial differential equations. The results were applied to a nonlinear problem. Dissert. Abstr.

N80-12813 Columbia Univ., New York.
GOOD FUNCTIONS, ELEMENTARY SETS AND AUTOMATA Ph.D. Thesis
Alan Littleford 1979 67 p
Avail: Univ. Microfilms Order No. 7924932

Characterization theorems are given for elementary series and good functions. In addition, elementary series are related to the structure of certain types of formal machines (automata) which generate them, and the concept of a good function is extended to the case f:N to the kth power approaches N|k > or = 2). A theorem is given which characterizes good f in the case CardSigma > or = 2 and combinatorial problems relating to the case CardSigma = 1 are discussed. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-12814# Sandia Labs., Albuquerque, N. Mex.
MOTION OF A MATERIAL WHOSE PARTICLE VELOCITY IS A LINEAR FUNCTION OF THE SPATIAL POSITION
J. M. McGlaun 10 Oct. 1978 41 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1423) Avail: NTIS HC A03/MF A01

The equations of motion are derived for plane one-dimensional motion of a material whose particle velocity is a linear function of the spatial position. It is proved the mass density is uniform at all times if it is initially uniform. A closed form solution to the equations of motion is obtained for a special case. Sensitivity of the solution to various parameters is investigated. An equation for the efficiency of a power history is derived and discussed. DOE

N80-12815# Oak Ridge National Lab., Tenn.
TURBULENT DESTABILIZATION AND SATURATION OF THE UNIVERSAL DRIFT MODE IN A SHEARED MAGNETIC FIELD
S. P. Hirshman and K. Molvig Nov. 1978 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6620) Avail: NTIS HC A02/MF A01

The turbulent diffusion of electrons across the rational surface, due to a combination of shear and random E Vector cross product B Vector fluctuations and/or stochastic magnetic perturbations is examined. A finite amplitude induced version of the absolute universal instability is shown to be the result of this process. The turbulent scattering of electrons across the rational layer which leads to an effective finite value is discussed. The electron growth at larger amplitudes is examined. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-12816 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL STUDY OF ACOUSTIC PROPAGATION AND ATTENUATION IN A CIRCULAR ANNULAR DUCT WITH A VARIABLE CROSS-SECTIONAL AREA Ph.D. Thesis
Roy Leslie Marshall 1979 142 p
Avail: Univ. Microfilms Order No. 7924125

A program to evaluate the performance of sound suppression techniques in ducts that produce refraction effects due to axial velocity gradients is described. The program employs a computer code based on the method of multiple scales to calculate the influence of axial variations due to slow changes in the cross sectional area as well as transverse gradients due to the wall boundary layers. The verification of the analytical model through direct comparison of experimental and computational results is presented. Comparison between the analytical predictions and the experimental measurements is made. The circumferential variations of pressure amplitudes and phases at several axial positions were examined in straight and variable area ducts, hard wall and lined sections with and without a mean flow. Dissert. Abstr.

N80-12817 Ohio Univ., Athens.
ULTRASONIC VELOCITY AND ABSORPTION MEASUREMENTS IN SEVERAL BINARY MIXTURES WITH PYRIDINE Ph.D. Thesis
Prem Kumar Gupta 1979 203 p
Avail: Univ. Microfilms Order No. 7924418

The structure and molecular processes in liquid mixtures were studied by measuring ultrasonic velocity and absorption in binary liquid mixtures of pyridine with heavy water, tertbutyl alcohol and phenol. These measurements were conducted with pulsed ultrasound at a frequency of 19.5 MHz at several temperatures between 5 C and 40 C. The velocity of sound in the pure liquids as a function of the temperature was measured. Dissert. Abstr.

N80-12818*# Lockheed-Georgia Co., Marietta.
A STUDY OF THE PREDICTION OF CRUISE NOISE AND LAMINAR FLOW CONTROL NOISE CRITERIA FOR SUBSONIC AIR TRANSPORTS Final Report, May 1977 - Jun. 1978
G. Swift and P. Mungur Aug. 1979 262 p refs
(Contract NAS1-14946)
(NASA-CR-159104; LG78ER0218) Avail: NTIS HC A12/MF A01 CSCL 20A

General procedures for the prediction of component noise levels incident upon airframe surfaces during cruise are developed. Contributing noise sources are those associated with the propulsion system, the airframe and the laminar flow control (LFC) system. Transformation procedures from the best prediction base of each noise source to the transonic cruise condition are established. Two approaches to LFC/acoustic criteria are developed. The first is a semi-empirical extension of the X-21 LFC/acoustic criteria to include sensitivity to the spectrum and directionality of the sound field. In the second, the more fundamental problem of how sound excites boundary layer disturbances is analyzed by deriving and solving an inhomogeneous Orr-Sommerfeld equation in which the source terms are proportional to the production and dissipation of sound induced fluctuating vorticity. Numerical solutions are obtained and compared with corresponding measurements. Recommendations are made to improve and validate both the cruise noise prediction methods and the LFC/acoustic criteria. A.R.H.

N80-12819*# Lockheed-Georgia Co., Marietta.
NEAR-FIELD NOISE PREDICTION FOR AIRCRAFT IN CRUISING FLIGHT: METHODS MANUAL Final Report, May 1977 - Jun. 1978
J. G. Tibbetts Aug. 1979 97 p
(Contract NAS1-14946)
(NASA-CR-159105; LG78ER0219) Avail: NTIS HC A05/MF A01 CSCL 20A

Methods for predicting noise at any point on an aircraft while the aircraft is in a cruise flight regime are presented. Developed for use in laminar flow control (LFC) noise effects analyses, they can be used in any case where aircraft generated noise needs to be evaluated at a location on an aircraft while under high altitude, high speed conditions. For each noise source applicable to the LFC problem, a noise computational procedure is given in algorithm format, suitable for computerization. Three categories of noise sources are covered: (1) propulsion system, (2) airframe, and (3) LFC suction system. In addition, procedures are given for noise modifications due to source soundproofing and the shielding effects of the aircraft structure wherever needed. Sample cases, for each of the individual noise source procedures, are provided to familiarize the user with typical input and computed data. A.R.H.

N80-12820*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND EFFECTS ON AIRCRAFT NOISE
William L. Willshire, Jr. and David A. Hilton Nov. 1979 71 p refs
(NASA-TM-80185) Avail: NTIS HC A04/MF A01 CSCL 20A

A flight experiment was conducted to investigate air-to-ground propagation of sound near grazing incidence. A turbojet-powered aircraft was flown at low altitudes over the ends of two microphone arrays. An eight-microphone array was positioned along a 1850 m concrete runway. The second array consisted of 12 microphones positioned parallel to the runway over grass. Twenty-eight flights were flown at altitudes ranging from 10 m to 160 m. The acoustic data recorded in the field reduced to one-third-octave band spectra and time correlated with the flight and weather information. A small portion of the data was further reduced to values of ground attenuation as a function of frequency and incidence angle by two different methods. In both methods, the acoustic signals compared originated from identical sources. Attenuation results obtained by using the two methods were in general agreement. The measured ground attenuation was largest in the frequency range of 200 to 400 Hz. A strong dependence was found between ground attenuation and incidence angle with little attenuation measured for angles of incidence greater than 10 to 15 degrees. A.R.H.

N80-12821*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL AND NUMERICAL RESULTS ON A SHEAR LAYER EXCITED BY A SOUND PULSE
Lucio Maestrello, Alvin Bayliss, and Eli Turkel Nov. 1979 47 p refs Presented at 32d Am. Phys. Soc. Meeting in Notre Dame, Indiana, 18-19 Nov. 1979
(NASA-TM-80183) Avail: NTIS HC A03/MF A01 CSCL 20A

The behavior of a sound in a jet was investigated. It is verified that the far-field acoustic power increased with flow velocity for the lower and medium frequency range. Experimentally, an attenuation at higher frequencies is also observed. This increase is found numerically to be due primarily to the interactions between the mean vorticity and the fluctuation velocities. Spectral decomposition of the real time data indicates that the power increase occurs in the low and middle frequency range, where the local instability waves have the largest spatial growth rate. The connection between this amplification and the local instability waves is discussed. Author

N80-12822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIME-DEPENDENT DIFFERENCE THEORY FOR NOISE PROPAGATION IN A TWO-DIMENSIONAL DUCT
Kenneth J. Baumeister 1979 13 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79298; E-249; AIAA-Paper-80-0098) Avail: NTIS HC A02/MF A01 CSCL 20A

A time dependent numerical formulation was derived for sound propagation in a two dimensional straight soft-walled duct in the absence of mean flow. The time dependent governing

acoustic-difference equations and boundary conditions were developed along with the maximum stable time increment. Example calculations were presented for sound attenuation in hard and soft wall ducts. The time dependent analysis were found to be superior to the conventional steady numerical analysis because of much shorter solution times and the elimination of matrix storage requirements. R.C.T.

N80-12823*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A TIME DEPENDENT DIFFERENCE THEORY FOR SOUND PROPAGATION IN DUCTS WITH FLOW
K. J. Baumeister 1979 38 p refs Presented at 98th Meeting of the Acoustical Soc. of Am., Salt Lake City, Utah, 26-30 Nov. 1979
(NASA-TM-79302; E-254) Avail: NTIS HC A03/MF A01 CSCL 20A

A time dependent numerical solution of the linearized continuity and momentum equation was developed for sound propagation in a two dimensional straight hard or soft wall duct with a sheared mean flow. The time dependent governing acoustic difference equations and boundary conditions were developed along with a numerical determination of the maximum stable time increments. A harmonic noise source radiating into a quiescent duct was analyzed. This explicit iteration method then calculated stepwise in real time to obtain the transient as well as the steady state solution of the acoustic field. Example calculations were presented for sound propagation in hard and soft wall ducts, with no flow and plug flow. Although the problem with sheared flow was formulated and programmed, sample calculations were not examined. The time dependent finite difference analysis was found to be superior to the steady state finite difference and finite element techniques because of shorter solution times and the elimination of large matrix storage requirements. R.C.T.

N80-12824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECIPROCITY PRINCIPLE IN DUCT ACOUSTICS
Young-chung Cho 1979 23 p refs Presented at 97th Meeting of the Acoustical Soc. of Am., Cambridge, Mass., 11-15 Jun. 1979
(NASA-TM-79300; E-250) Avail: NTIS HC A02/MF A01 CSCL 20A

Various reciprocity relations in duct acoustics have been derived on the basis of the spatial reciprocity principle implied in Green's functions for linear waves. The derivation includes the reciprocity relations between mode conversion coefficients for reflection and transmission in nonuniform ducts, and the relation between the radiation of a mode from an arbitrarily terminated duct and the absorption of an externally incident plane wave by the duct. Such relations are well defined as long as the systems remain linear, regardless of acoustic properties of duct nonuniformities which cause the mode conversions.
Author

N80-12825# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SHALLOW BULK ACOUSTIC WAVES
Arthur Ballato and Theodore Lukaszek Jun. 1979 49 p refs (DA Proj. 1L1-62705-AH-94)
(AD-A072742; DELET-TR-79-13) Avail: NTIS HC A03/MF A01 CSCL 20/1

Shallow bulk acoustic wave propagation in piezoelectric crystals is considered from the standpoint of work reported to date. It is compared to bulk and surface acoustic waves as to properties and device potential. Singly and doubly rotated cuts are considered, as are piezoelectric transduction, energy trapping equivalent networks, as well as areas of future work such as new materials, other than quartz, and nonlinear effects. GRA

N80-12826# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
GENERAL EFFECTS OF CURRENT AND SOUND-SPEED VARIATIONS ON SHORTRANGE ACOUSTIC TRANSMISSION IN CYCLONIC EDDIES
M. J. Jacobson, W. L. Siegmann, and R. F. Henrick 1 Jul. 1979 59 p refs
(Contract N00014-76-C-0288)
(AD-A072765; RPI-MATH-125) Avail: NTIS HC A04/MF A01 CSCL 20/1

The effects of sound-speed and current variations induced by a mesoscale cyclonic eddy on short-range propagation are considered. A parametric eddy model is used to determine acoustically-relevant eddy environmental effects, so that eddy-acoustical effects can be determined for eddies of arbitrary size, strength, and position. Approximations to sound-speed and current structures are used to investigate eddy effects on the three-dimensionality of rays and on ray types. The influence of current and sound-speed variations on travel time is examined, and accurate expressions for per-ray phase variation are obtained. Examples are presented illustrating effects of source-receiver position and orientation on per-ray phase shifts and relative phase spreading of arrivals. Also, general results are presented which illustrate the variations of eddy-acoustical effects as functions of source-receiver range and of eddy size and strength. GRA

N80-12827# Texas Univ. at Austin. Applied Research Labs.
SHEAR WAVE PROPAGATION IN UNCONSOLIDATED FLUID SATURATED POROUS MEDIA
David Warren Bell 15 May 1979 180 p refs
(Contract N00014-76-C-0117)
(AD-A072867; ARL-TR-79-31) Avail: NTIS HC A09/MF A01 CSCL 20/1

Experimental shear wave speed and attenuation measurments are reported for seven laboratory sediments. The samples consisted of four sizes of well sorted glass beads and three natural sands. Measurements were obtained for both air and water saturation without application of external pressure. The speed and attenuation for each sample was determined from the change with transducer separation of the transit time and amplitude of an acoustic pulse. Broadband bender elements provided an overall frequency range of 600 Hz to 200 kHz, with individual sediment ranges of approximately a decade. The attenuation was found to vary approximately as the first power of the frequency. Various physical characteristics of the samples, for example, density and permeability, are reported to allow comparison of the experimental results with theoretical predictions. Supplementary compressional wave speed and attenuation measurements at the single frequency of 120 kHz are also provided. A simple viscoelastic model based on perfect coupling between the sediment grains and the pore fluid predicts the main features of the observed data. There is evidence, however, of an effect due to relative motion between the grains and the fluid. GRA

N80-12025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROACOUSTIC CHARACTERIZATION OF FREE JETS
Georges Elias, Annie Lelarge, Jean Maulard, and Mariano Perulli *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1978-5 Jul. 1979 p 55-69 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1978-5, Sep. - Oct. 1978 p 251-261 Original language report was announced as A79-18534 (For primary document see N80-12021 03-01) Avail: NTIS HC A06/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-12828 Wisconsin Univ. - Madison.
MICROWAVE SPECTRA AND THEORETICAL CALCULATION OF TRANSIENT MOLECULES Ph.D. Thesis
Peter George Szanto 1979 207 p
Avail: Univ. Microfilms Order No. 7919822

Ab-initio calculations, an alternate method for the determination of the structure of ions, are discussed. An SCF + CI calculation was carried out on CN(+) with the following objectives in mind: determination of the ground state of the species and its dipole moment - which at present is inaccessible by any other method - and to gauge the feasibility of predicting microwave transitions by a relatively simple and inexpensive method. The

electronic energy was calculated for the lowest states. The equation of motion of the nuclei was solved numerically to yield the rotational and vibrational levels of both electronic states. The first terrestrial observation of protonated nitrogen, N2h(+), was made in our liquid nitrogen cooled glow discharge apparatus. The theory of an asymmetric rotor with up to two unpaired electrons and up to two magnetically nonequivalent nuclei is developed and encoded in a FORTRAN program. Dissert. Abstr.

N80-12829 North Carolina Univ. at Chapel Hill.
ANALYSIS OF COHERENT ANTI-STOKES RAMAN SPECTRA: DETERMINATION OF MOLECULAR PARAMETERS Ph.D. Thesis
James Wainscott Fleming 1979 106 p
Avail: Univ. Microfilms Order No. 7925908

Expressions for the intensity arising from coherent anti-Stokes Raman scattering (CARS) were analyzed for both CARS and for resonance CARS. Measurable experimental quantities including the relative intensity and exact frequency position of the maximum and minimum for a single line spectrum are shown to be related to the third order nonresonant susceptibility, Raman scattering cross section, Raman vibrational frequency, and Raman linewidth. Single line approximations are discussed and experimental data presented to validate the relationships between measured and molecular parameters. The consequences of more than one line are examined and an analysis appropriate for several lines is given and experimental data presented. Using the relationships available in this study, polarization properties of CARS spectra are discussed and a quantitative treatment of the Kleinman symmetry conjecture, local field correction factor, and the Raman depolarization ratio is given. Dissert. Abstr.

N80-12830 Michigan Univ., Ann Arbor.
ELECTRON CORRELATION AND HUND'S RULE Ph.D. Thesis
John William Warner 1979 76 p
Avail: Univ. Microfilms Order No. 7925241

The traditional interpretation of Hund's (Nule, now known to be incorrect, is discussed and an alternative approach is presented. It is suggested that for two electron configurations built up out of orbitals with different orbital angular momenta, the angular correlation introduced by symmetrizing the wavefunction with respect to particle exchange gives rise to the following shielding effect: the electrons will be at wider angles in either the singlet or the triplet state. In the state in which the electrons are at wider angles, the outer electrun feels more of the effective nuclear charge, causing a contraction of the outer orbital and a lowering of the energy. This approach gives rise to the following alternating rule: for the state of greatest total orbital angular momentum in an atomic configuration, the singlet lies above the triplet. The ordering of energy levels reverses for the state of next higher orbital angular momentum, and continues to alternate with each change of one unit in the total orbital angular momentum until the state of lowest orbital angular momentum is reached. Dissert. Abstr.

N80-12831 Harvard Univ., Cambridge, Mass.
VIBRATION-TORSION INTERACTION IN THE MICROWAVE SPECTRUM OF METHYL MALONALDEHYDE Ph. D. Thesis
Nigel Denis Sanders 1979 149 p
Avail: Univ. Microfilms Order No. 7925307

The microwave spectrum of methylmalonaldehyde was measured and the molecule shown to be in an intramolecularly hydrogen bonded chelate form in the gas phase. The spectrum shows the effects of two large amplitude internal motions: the torsion of the methyl group about its symmetry axis and the inversion of the hydrogen bonded ring through a potential barrier to a C sub 2 sub v conformation. A two vibration plus rotation model is developed and applied to explain the sizeable perturbations of the pure rotational transitions in four ground state sublevels from a rigid rotor pattern. The experimentally derived parameters are discussed in terms of an effective inversion-torsion potential surface. Some aspects of the gas phase decomposition kinetics of tetramethyldioxetane are discussed in relation to attempts to obtain its microwave spectrum. Dissert. Abstr.

N80-12832 Wisconsin Univ. - Madison.
GROUND STATE ENERGY OF MOLECULAR TRIMERS Ph.D. Thesis
Fernando Cabral 1979 138 p
Avail: Univ. Microfilms Order No. 7918142

The ground state energy of dimer and trimer systems in two and three dimensions is calculated. Both the boson case and the case of three spin 1/2 particles are treated. A Jastrow variational calculation with one variational parameter, a Monte Carlo simulation, and a lower bound calculation are performed for the trimer boson in three dimensions. For the fermion case only a variational work is done. A variational calculation is done for the fermion case and boson case in two dimensions. An exploratory variational calculation using nonorthogonal basis set is performed for the boson trimer in three dimensions. Dissert. Abstr.

N80-12833 Wisconsin Univ. - Madison.
THE STUDY OF BONDING IN SILICON COMPOUNDS BY FENSKE-HALL MOLECULAR ORBITAL CALCULATIONS AND PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Francis Charles Burns 1979 556 p
Avail: Univ. Microfilms Order No. 7919788

Calculations with and without silicon 3d orbitals were performed for three series of small silanes, SiH(4-x)Yx, SiHCl(3-x)(CH3)x, and for pentacarbonyl manganese silanes, Y3Si(Mn(CO)5 and Cl(3-x)(CH3)xSiMn(CO). The PE spectra was measured for the SiHCl(3-x)(CH3)x and the manganese compounds. For the small silanes, the silicon 3d orbital contributed only to the higher occupied orbitals. Electron density was acquired by the silicon 3d orbitals by rearrangement of electron density from the silicon 3s and 3p orbitals and by transfer of electron density from the atoms bonded to the silicon. Most of the electron density acquired by the Si 3d orbitals, through transfer, resulted from dpi-ppi interactions; however, the amount of dpi-ppi bonding is small, and did not correlate with the electronegativity of the atoms. The silicon 3d orbitals had an indirect effect on the character of the molecular orbitals by changing the energy of the other basis orbitals. Dissert. Abstr.

N80-12834# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATICS, SMALL PARTICLES, AND LASER FUSION TARGETS
C. D. Hendricks 26 Sep. 1978 20 p refs Presented at the Inst. of Electrostatics Meeting, Tokyo, 26 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81537; CONF-7811125-1) Avail: NTIS HC A02/MF A01

A discussion of an inertial confinement fusion system for the production of useful power and its dependence on the production of suitable targets is presented. The target characteristics such as material composition, structure, and surface finish which are tailored to the laser pulse length, energy, peak and average power, and pulse shape are examined. The physics of the interaction of laser pulse and target, and the number of different types of targets necessary to study laser fusion are discussed. DOE

N80-12835# Los Alamos Scientific Lab., N. Mex.
PARITY VIOLATION IN THE SCATTERING OF 15 MeV PROTONS BY HYDROGEN
D. E. Nagle, J. D. Bowman, C. Hoffman, J. McKibben, R. Mischke, J. M. Potter, H. Frauenfelder (Illinois Univ.), and L. Sorenson (Illinois Univ.) 1978 8 p refs Presented at Symp. on High Energy Physics, Argonne, Ill., 26-28 Oct. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2875; CONF-781095-2) Avail: NTIS HC A02/MF A01

A transmission experiment to measure the longitudinal asymmetry for polarized protons on hydrogen is described. The present result is (-1.7 + or - 0.8) X 10 to the -7th power. DOE

N80-12836# California Univ., Berkeley. Lawrence Berkeley Lab.
THE EXPERIMENTAL SUPERCONDUCTING SYNCHROTRON (ESCAR) Final Report
G. R. Lambertson, W. S. Gilbert, and J. B. Rechen 1 Mar. 1979 119 p refs
(Contract W-7405-eng-48)

(LBL-8211) Avail: NTIS HC A06/MF A01

Topics covered include the Lattice and beam parameters; superconducting magnets and cryostats; refrigeration and cryogenic distribution; vacuum systems; electrical systems; and conventional facilities. DOE

N80-12837# Oak Ridge National Lab., Tenn.
POLARIZED NEUTRON DIFFRACTION IN HIGH MAGNETIC FIELDS
R. M. Moon Jul. 1978 21 p refs Presented at Conf. on Solids and Plasmas in High Magnetic Fields, Cambridge, Mass., 18 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780927-1) Avail: NTIS HC A02/MF A01

The use of magnetic fields in the general area of neutron scattering is briefly surveyed, and some specific areas of research are identified which would benefit by the availability of higher fields. Since most of the past work combining neutron scattering and high magnetic fields has involved the polarized neutron technique, a description of this technique is presented along with a discussion of experimental errors produced by the magnetic field. The current status of polarized-beam research in four areas is reviewed: induced form factors in transition metals, mixed-valence systems, Kondo systems, and complicated paramagnets. DOE

N80-12838# Ames Lab., Iowa.
APPLICATIONS OF SOLID STATE NUCLEAR MAGNETIC RESONANCE TECHNIQUES TO THE STUDY OF COALS AND POLYMERS Ph.D. Thesis
R. G. Pembleton Jan. 1979 184 p refs
(Contract W-7405-eng-82)
(IS-T-822) Avail: NTIS HC A09/MF A01

The use of nuclear magnetic resonance (NMR) to study molecules in the solid state has grown rapidly over the past several years. This is due to the advent of techniques which allow for the removal of certain interactions in the solid state which previously have thwarted most attempts at obtaining chemical shift or their anisotropies. With these parameters and others now available, NMR has become an important tool to be used in the understanding of the chemistry of solids. The work reported applies the techniques of solid state NMR to a number of chemical systems. Specific applications are made to crystallinity in polymers, to combined sample spinning and multiple pulse techniques, and to aromatic and aliphatic content of vitrain portions of coals of varying carbon content. DOE

N80-12839# California Univ., Livermore. Lawrence Livermore Lab.
HIGH-PRESSURE AND HIGH-TEMPERATURE BEHAVIOR OF SIMPLE AND COMPLEX MOLECULAR LIQUIDS
F. H. Ree and Marvin Ross 19 Jul. 1979 8 p refs Presented at 7th Intern. AIRAPT Conf., La Creusot, France, 30 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-82129; CONF-790709-11) Avail: NTIS HC A02/MF A01

Recent theories in statistical mechanics and intermolecular forces are used to explain the shock-wave data of inert gases (Ar, Xe), diatomic molecules (H2, N2), and hydrocarbons. DOE

N80-12840# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
HIGH TEMPERATURE FACILITY FOR ATOMIC PHYSICS STUDIES Final Report
15 Dec. 1978 22 p refs
(Contract W-7405-eng-48)
(UCRL-13969) Avail: NTIS HC A02/MF A01

A program designed to develop a laser heated plasma sample for atomic physics studies in the 30 to 100 eV range of electron temperature and the range in electron density is presented. The approach used is discussed in detail. An extensive rework of the plasma sample facility, specifically, a new solenoid magnet constructed to allow higher field operation, and the plasma chamber, modified to allow the use of puff filling orifices and small bore tube liners is described. Changes in the vacuum system, focussing optics, and the 10 liter CO2 laser optics are evaluated. DOE

N80-12841# Argonne National Lab., Ill. Applied Physics Div.
SCATTERING OF MeV NEUTRONS FROM ELEMENTAL IRON
A. Smith and P. Guenther Mar. 1979 43 p refs
(Contract W-31-109-eng-38)
(ANL/NDM-47) Avail: NTIS HC A03/MF A01

Neutron elastic- and inelastic-scattering cross sections of elemental iron were measured from 1.5 to 4.0 MeV with incident-neutron resolutions of less than or approx. = 50 keV and at incident-neutron energy intervals of less than or approx. = 50 keV. Cross sections for the excitation of observed levels at 0.853, 1.389, 2.097, 2.579, 2.677, 2.974 and 3.152 MeV were determined. The observed elastic- and inelastic-scattering angular distributions fluctuate strongly with incident energy. The experimental results are averaged over broad energy intervals and interpreted in terms of spherical optical-statistical and coupled-channels models including consideration of direct-vibrational excitations. The importance of a comprehensive data base in such energy-averaged interpretations and of the direct-vibrational excitations is stressed. The present measured and calculated results, combined with those reported in the literature, are used to formulate an evaluated scattered-neutron data file in the ENDF format extending from 1.0 to 4.0 MeV. DOE

N80-12842# Texas Univ., Austin. Center for Particle Theory.
RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY Progress Report, 1978 - 1979
E. C. G. Sudarshan and Y. Ne'eman 1979 79 p
(Contract EY-76-S-05-3992)
(ORO-3992-362) Avail: NTIS HC A05/MF A01

A theoretical high energy physics research program is summarized. Topics include the foundation of quantum theory, particle physics in relativistic astrophysics, the phenomenology of weak and electromagnetic interactions, strong interaction physics, and supersymmetry and supergravity. A.W.H.

N80-12843# Texas A&M Univ., College Station. Cyclotron Inst.
X-RAY EMISSION IN HEAVY-ION COLLISION Progress Report, 1 Jul. 1978 - 30 Jun. 1979
R. L. Watson Apr. 1979 75 p refs
(Contract ER-78-S-05-6036)
(ORO-6036-1) Avail: NTIS HC A04/MF A01

Studies of spectra of X-rays produced in heavy-ion collisions are reported. The aims of these studies are: (1) to attain a better understanding of the mechanisms for multiple inner-shell ionization of target atoms; (2) to characterize the fast rearrangement processes that occur following multiple inner-shell ionization; (3) to utilize K-alpha X-ray satellite and hypersatellite structure to study the equilibration of inner-shell vacancy states in fast ions penetrating solid targets; and (4) to investigate the effects of surface interactions on the polarization of X-rays emitted by highly stripped ions emerging from thin foils. A summary of studies in each of these areas is presented. DOE

N80-12844# California Inst. of Tech., Pasadena.
CASCADE OF NEGATIVE MUONS IN ATOMS Ph.D. Thesis
V. R. Akylas 1978 80 p refs
(Contracts EY-76-C-03-0063; AT(04-3)-63)
(CALT-63-300) Avail: NTIS HC A05/MF A01

The evolution is studied of a negative muon captured in an atom and the formalism of energy loss associated with the muonic atom. The principal goals are to calculate reliability the muon X-ray intensities, given the initial population of the muonic orbits, to invert the problem and deduce the initial distribution from the X-ray intensities, to provide a reasonably simple and convenient tool to correlate observations, and finally, to systematize some questions of theoretical interest. The early part of the history of the muon in matter, including the atomic capture and classical phase of the atomic cascade are reviewed. In the quantal treatment of the transition rates, both radiative and electron Auger transitions are considered. In general, multipolarities up to E3 and K, L and M electronic shells are fully investigated. Multipole radiation is treated in the conventional way and presents no special problems. Magnetic type transitions between states with different principal quantum numbers are shown to be small. The basic

results have been compared in terms of elementary functions.
DOE

N80-12845# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
STUDIES OF ELECTRON CORRELATION IN THE PHOTOIONIZATION PROCESS Ph.D. Thesis
R. A. Rosenberg Mar. 1979 200 p refs
(Contract W-7405-eng-47)
(LBL-8948) Avail: NTIS HC A09/MF A01

Electron correlation is a result of the interaction of two or more electrons confined in a region of space, and may conveniently be treated under the formalism of configuration interaction (CI). Photoionization provides a rather direct experimental method for studying CI. The types of CI involved in the photoionization process can be divided into three categories: initial-state configuration interaction (ISCI), final-ionic-state configuration interaction (FISCI), and continuum-state configuration interaction (CSCI). The photoelectron spectroscopy of Ba, Sm, Eu, and Yb was studied using both HeI (22.22 eV) and NeI (16.85 eV) radiation. Satellite structure observed in these spectra using NeI (and for Yb, HeI also) radiation could be satisfactorily explained by ISCI alone. The HeI spectra of Sm, Eu, and, in particular, Ba showed dramatic changes in the satellite population which could only be explained by autoionization, a special form of CSCI. The detailed nature of the mechanism was explored in Ba with synchrotron radiation. It was found that the autoionizing level decays preferentially via an Auger-type mechanism. DOE

N80-12846# Louisiana State Univ., Baton Rouge.
ELECTRON-IMPACT EXCITATION OF n = 2 LEVELS OF HELIUM AT INTERMEDIATE ENERGIES
K. Bhadra, J. Callaway, and R. J. W. Henry 1979 43 p refs
(Contract EY-76-S-05-4881)
(ORO-4881-24) Avail: NTIS HC A03/MF A01

Five state close coupling equations for electron-helium scattering are solved in the energy region from 30 to 100 eV. Integral and differential cross sections for excitation of the ground state to the $n = 2$ states are presented. Calculated shapes of differential cross sections versus angle for various energies are compared with measurements. DOE

N80-12847# Ames Lab., Iowa.
HYDRODYNAMIC MODEL WAVEFUNCTIONS IN INTRINSIC COORDINATES AND THEIR APPLICATION TO THE STRUCTURE OF EVEN-EVEN NUCLEI
F. J. Margetan Jan. 1979 494 p refs
(Contract W-7405-eng-82)
(IS-T-825) Avail: NTIS HC A21/MF A01

A closed expression is presented for intrinsic-coordinate eigenfunctions of the hydrodynamic, quadrupole-vibration Hamiltonian of A. Bohr. These functions are used as an expansion basis for the treatment of more general collective Hamiltonians. Two classes of such Hamiltonians are considered. In each, the potential energy term of the Bohr Hamiltonian was replaced with a more general function of the shape coordinates. The potential of Gneuss and Greiner (1) is used to demonstrate the soundness of the calculational techniques, and to illustrate convergence properties of calculated energies. Potentials possessing a single minimum on 0 less than or equal to gamma less than or equal to 60 deg are considered through the study of a quadratic-potential [QP] Hamiltonian. The smooth development from spherical to asymmetrically deformed nuclear shapes is investigated. Model energies and E2 transition rates are traced during this process. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-12848 State Univ. of New York at Stony Brook.
PARTICLE PRODUCTION IN HIGH-ENERGY REACTIONS AND STUDIES IN A GAUGE MODEL Ph.D. Thesis
Rohini Madhusudan Godbole 1979 104 p
Avail: Univ. Microfilms Order No. 7925416

In a gauge field model of weak and electromagnetic interactions the weak correction to the anomalous magnetic moment of the muon is calculated. The experimental bounds on this quantity fail to constrain the mass of the neutral boson or the heavy neutral lepton. The calculation is done in a general gauge and use of Slavnov-Taylor identities enable the removal of all the gauge dependence before the loop integration is performed. The production of a Higgs boson and neutral vector mesons in neutrino and antineutrino scattering is calculated. The possibility of observing the Higgs boson production in neutrino scattering is discussed. Also, the production of rho meson(o) in e(+)e(-) colliding beams, up to the energies corresponding to PEP and PETRA, is calculated. Dissert. Abstr.

N80-12849 Columbia Univ., New York.
DIRECTIONAL DISTRIBUTIONS OF BETA-RAYS EMITTED FROM ORIENTED NUCLEI Ph.D. Thesis
Leo Maria Freishyn Chirovsky 1979 156 p
Avail: Univ. Microfilms Order No. 7924864

A new ultralow temperature nuclear orientation facility was developed with which the directional distributions of Beta rays emitted from statically polarized nuclei are observed, for the first time, at many angles with respect to the polarization axis. Nuclei are polarized in bulk by imbedding them in an appropriate ferromagnetic host, which is cooled to near absolute zero temperature and is magnetized to saturation with an externally applied field. The polarization axis is defined by the direction of this applied field. The angular dependence of the parity violating term in the directional distribution function for beta rays emitted from polarized Co(60) nuclei was directly measured for the first time. The results were found to be consistent with the accepted theories of nuclear beta decay. Additional fundamental experiments possible with this new facility involving parity violation, isospin nonconservation and time-reversal invariance are discussed.
Dissert. Abstr.

N80-12850 Pittsburgh Univ., Pa.
PION-NUCLEUS SCATTERING USING FINITE BINDING POTENTIALS Ph.D. Thesis
Michael David Silver 1979 133 p
Avail: Univ. Microfilms Order No. 7924683

A nonperturbative treatment of finite binding potentials in pion bound nucleon scattering is developed. Coupled differential equations in configuration space are derived from a model wavefunction broken into two parts. Coordinates from the source of binding to the pion and to the nucleon are used in the elastic channel, while pion nucleon center of mass coordinates are used for the excited channels. The excited channel equations are solved in closed form using a separable nonlocal pion nucleon interaction. When inserted into the elastic channel equation, a relativistically modified single particle equation for the elastically scattered meson is derived, which features an optical potential with both local and nonlocal parts. This model is used in conjunction with first order multiple scattering theory to construct pion nucleus scattering. The assumed pion nucleon interaction is taken to be s waves with threshold p wave behavior. The region around the 33 resonance is numerically studied for both the three body model and for pions on O-16. Dissert. Abstr.

N80-12851*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MINIATURE CYCLOTRON RESONANCE ION SOURCE USING SMALL PERMANENT MAGNET Patent Application
Vincent G. Anicich and Wesley T. Huntress, inventors (to NASA)
Filed 11 Sep. 1978 13 p
(NASA-Case-NPO-14324-1; US-Patent-Appl-SN-940970) Avail: NTIS HC A02/MF A01 CSCL 20H

An ion source using the cyclotron resonance principle is presented. A miniaturized ion source device in an air gap of a small permanent magnet with a substantially uniform field in the air gap of about 0.5 inches is described. The device and permanent magnet are placed in an enclosure which is maintained at a high vacuum into which a sample gas is introduced. A discussion of how the invention avoids the problem of getting

the ion beam coupled into the utilization system is presented.
NASA

N80-12852# California Univ., Livermore. Lawrence Livermore Lab.
RESEARCH ON THE ANNULAR LITHIUM JET CONCEPT FOR FUTURE LASER-FUSION REACTORS Final Report, Sep. 1977 - Dec. 1978
M. A. Hoffman Dec. 1978 34 p refs
(Contract W-7405-eng-48)
(UCRL-13938; FR-3) Avail: NTIS HC A03/MF A01

Experiments were performed to determine the length for convergence or closure of a vertical, hollow annular water jet due to the action of surface tension forces. The data agree well with theoretical predictions up to a velocity of about 3 m/s. At higher velocities, the convergence lengths are less than predicted and this is attributed to the jet acting as an ejector pump and thereby reducing the air pressure inside the annulus to slightly sub-atmospheric values. The stability of such a jet is also discussed in the light of the fact that no hydrodynamic instabilities were yet observed. The results of a series of experiments on the flow spreading or splitting due to the presence of wedge-shaped obstacles in the path of the annular jet flow are described. DOE

N80-12853# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF SALT BEDS IN NEW MEXICO AS A GEOLOGIC REPOSITORY FOR NUCLEAR WASTE
W. D. Weart Oct. 1978 36 p Presented at the Environmental Control Symp., Washington, D. C., 28 Nov. 1978
(Contract EY-76-C-04-0789)
(SAND-78-2066C; CONF-781109-5) Avail: NTIS HC A03/MF A01

The Department of Energy is proposing to demonstrate the acceptability of geologic disposal of radioactive waste by locating a waste isolation pilot plant (WIPP) in the salt beds 26 miles east of Carlsbad, New Mexico. The WIPP will serve as a permanent repository for defense generated transuranic contaminated waste and will also be used as a facility in which experiments and demonstrations with all radioactive waste types can be conducted. Rock salt has been the leading candidate for geologic disposal of nuclear waste since the National Academy of Science recommended in 1957 that salt for repositories receive further evaluation. Subsequent studies have failed to reveal any phenomena which would disqualify salt beds as a repository medium. The present area being proposed for the WIPP is the second such location in the Delaware Basin for which new site data have been developed; the first site proved geologically unacceptable. DOE

N80-12854# Los Alamos Scientific Lab., N. Mex.
GENERAL PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report
R. D. Baker, (comp.) Dec. 1978 39 p
(Contract W-7405-eng-36)
(LA-7601-PR) Avail: NTIS HC A03/MF A01

The studies reported are related to the use of Pu 238 O2 in radioisotopic power systems. The three programs involved are: (1) general-purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety. DOE

N80-12855# California Univ., Livermore. Lawrence Livermore Lab.
SUGGESTED NUCLEAR WASTE MANAGEMENT RADIOLOGICAL PERFORMANCE OBJECTIVES
J. Cohen Dec. 1978 43 p refs
(Contract W-7405-eng-48)
(NUREG-CR-0579; UCRL-52626) Avail: NTIS HC A03/MF A01

Development of criteria for the safe disposal of nuclear wastes in geologic media requires the establishment of definitive objectives against which the adequacy of various waste management methods may be judged. Certain guidelines are suggested that might serve as first approximations pending promulgation of official criteria. These include: the allowable radiation dose to individuals should be related to the predicted probability of receiving the dose such that as the dose increases, the events leading to that dose should become less probable. A quantitative relationship is developed and discussed. Selection of a waste management method should be made in accordance with the principles of ALARA. Doses to future generations should be considered to be equally as serious as doses to present populations. When the hazard potential of an underground nuclear waste repository becomes less than that of typical hazardous ore formations (i.e., 0.2% uranium ore), further concern is unwarranted. DOE

N80-12856# Analytic Sciences Corp., Reading, Mass.
ANALYSIS OF SOME NUCLEAR WASTE MANAGEMENT OPTIONS. VOLUME 1: ANALYSIS AND INTERPRETATION
L. E. Berman, D. A. Ensminger, M. S. Giuffre, C. M. Koplik, S. G. Oston, G. D. Pollak, and B. I. Ross 10 Oct. 1978 141 p refs
(Contract W-7405-eng-48)
(UCRL-13917-Vol-1) Avail: NTIS HC A07/MF A01

Risk analyses were performed on that portion of a nuclear fuel cycle which begins following solidification of high-level waste. Risks associated with handling, interim storage and transportation of the waste are assessed, as well as the long term implications of disposal in deep mined cavities. The risk is expressed in terms of expected dose to the general population and peak dose to individuals in the population. DOE

N80-12857# Maryland Univ., College Park. Dept. of Physics and Astronomy.
HIGH ENERGY ACCELERATOR AND COLLIDING BEAM USER GROUP Progress Report, 1 Feb. 1977 - 31 Jan. 1978
G. A. Snow 1978 82 p refs
(Contract EY-76-C-05-2504)
(ORO-2504-273) Avail: NTIS HC A05/MF A01

A summary of high energy physics studies is presented. Topics covered include e(+-)e(-)) experiments; weak interactions; and electromagnetic and strong interaction experiments. DOE

N80-12858# Atomics International Div., Richland, Wash. Energy Systems Group.
ENGINEERING STUDY OF DRY NEAR-SURFACE INTERIM STORAGE OF FAST FLUX TEST FACILITY SPENT FUEL
Nov. 1978 66 p refs
(Contract EY-77-C-06-1030)
(RHO-LD-66) Avail: NTIS HC A04/MF A01

The methods for dry, near-surface storage of fast flux test facility (FFTF) spent driver fuel assemblies in the 200 Area at Hanford was accessed. The disposable cask, drywell and vault concepts are the most promising approaches for FFTF spent fuel storage in the Hanford 200 Area Starting in 1986. The cost and risk for the vault concept are higher than for either the disposable cask or drywell concepts. The disposal cask and drywell concepts are both satisfactory for this application. The risk for any of these concepts is minimal. Design and construction of a disposable cask or drywell facility can be completed within the constraint of a 1986 startup date if the project is initiated in fiscal year-1980. DOE

N80-12859# California Univ., Livermore. Lawrence Livermore Lab.
ACTINIDE CROSS SECTION DATA AND INERTIAL CONFINEMENT FUSION FOR LONG TERM WASTE DISPOSAL
H. Meldner 15 Jan. 1979 11 p refs Presented at the Conf. on Nucl. Data of Higher Plutonium and Americium Istopes for Reactor Appl., Upton, N. Y., 20-22 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-82177; CONF-781174-6) Avail: NTIS HC A02/MF A01

Actinide cross section data at thermonuclear neutron energies needed for the calculation of ICF pellet center burnup of fission reactor waste, viz. 14 MeV neutron fission of the very long lived actinides that pose storage problems are examined. The actinide data tables required for Monte Carlo calculations of the burnup of Am-241 and Am-243 are discussed in connection with typical burnup reactor fusion and fission spectra. DOE

N80-12860# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY AREA SELECTION CONSIDERATIONS FOR RADIOACTIVE WASTE REPOSITORIES IN BEDDED SALT
J. L. Wagoner and T. L. Steinborn 12 Jun. 1979 52 p refs
(Contract W-7405-eng-48)
(UCID-18122) Avail: NTIS HC A04/MF A01

An approach to selection of areas of bedded salt which *contain potentially suitable sites for the storage of radioactive* waste is described. To evaluate a site selected by a license applicant, it is necessary to understand the technical site *characteristics which should be considered in the preliminary* phase of site selection. These site characteristics are presented in checklist form, and each item is accompanied by a discussion *which explains its significance. These qualitative considerations* are used first to select an area of interest within a broad geologic or geomorphic region. Once an area has been selected, *more quantitative information must be acquired to determine whether* the proposed site meets the resultations for storage of nuclear waste. DOE

N80-12861# California Univ., Berkeley. Lawrence Berkeley Lab.
***INDEPENDENT PARTICLE ASPECTS OF NUCLEAR DYNAMICS* Ph.D. Thesis**
M. C. Robel May 1979 290 p refs
(Contract W-7405-eng-48)
(LBL-8181) Avail: NTIS HC A13/MF A01

A generalization of the independent particle model from nuclear statics to nuclear dynamics is sought. Attention is centered on the average behavior of nuclear dynamics, as opposed to *detailed behavior, such as that characteristic of shell effects in* nuclear statics. In many situations, all that is needed is a model of dissipation in nuclear dynamics. DOE

N80-12862# Notre Dame Univ., Ind. Dept. of Physics.
MULTIQUARK MESONS
S. K. Bose and E. C. G. Sudershan (Texas Univ., Austin) Nov. 1978 6 p refs
(Contract EY-76-S-05-3992)
(ORO-3992-355) Avail: NTIS HC A02/MF A01

Coupling schemes are considered for multiquark mesons, *specifically those connecting the diquark-antidiquark mesons to* conventional mesons and baryons. The resulting unique scheme is given, where the wave function is the three-quark composite *baryon tensor having given properties.* DOE

N80-12863# Los Alamos Scientific Lab., N. Mex.
COMPLEMENTARITY BETWEEN NEUTRON CAPTURE AND HEAVY-ION REACTIONS IN NUCLEAR STRUCTURE STUDIES
O. W. B. Schult 1978 19 p refs Presented at the 3d Intern. Symp. on Neutron Capture of Gamma-ray Spectry., Upton, N. Y., 18-22 Sep. 1978
(Contract W-7405-eng-36)
(LA-UR-78-2432; CONF-780926-21) Avail: NTIS HC A02/MF A01

Neutron capture and heavy ion reactions are examined in terms of their relevancy to the study of nuclear structure. *Spectroscopic methods employed for the study of nuclear structure* are reviewed. Nuclear rotation and coupling of nucleons to the core and the de-excitation and structure of high lying states are *among the topics covered.* DOE

74 OPTICS

Includes light phenomena.

N80-12864 Pittsburgh Univ., Pa.
EFFECT OF DIMER DISSOCIATION ON DEPOLARIZED SCATTERED LIGHT IN DILUTE GASES Ph.D. Thesis
Frank John Paul Perzak 1979 90 p
Avail: Univ. Microfilms Order No. 7924677

A simple model for calculating the depolarized scattered light *from dilute gases of isotropic species is derived using classical* mechanics, and the results are compared with experimental data. *Triple collisions are neglected. Binary collisions are considered* to be transient dimers which translate and rotate in accordance *with Maxwellian distribution laws, and they are assumed to* dissociate at an apparent first order rate. The effect of the more stable dimers (i.e., dimers with negligible rate of dissociation) is *also considered. The equilibrium concentration of these stable* dimers is calculated for argon, xenon, and methane at 300 K, and the resulting scattered light is found to be a small fraction *of the total scattering in agreement with earlier calculations.* Dissert. Abstr.

N80-12865 Clarkson Coll. of Technology, Potsdam, N.Y.
THE 360 DEG LIGHT SCATTERING PHOTOMETER FOR SINGLE PARTICLE ANALYSIS Ph.D. Thesis
Marty Frank Bartholdi 1979 174 p
Avail: Univ. Microfilms Order No. 7925428

Light scattering by single spherical homogeneous particles *in the diameter range 1 to 20 micrometers and relative refractive* index 1.20 is measured. Particle size of narrowly dispersed populations is determined and a multimodal dispersion of five components is completely analyzed. The design and development of a 360 deg. light scattering photometer for analysis of single *particles is presented.* A fluid stream containing single particles intersects a focused laser beam at the primary focal point of an ellipsoidal reflector ring. The intensity and angular distribution of *light scattered by spherical particles are indicative of size and* relative refractive index. Calculations, using Lorenz-Mie theory, of differential scattering patterns integrated over angle correspon*ding to the detector geometry determined the instrument response* to particle size. From this, the expected resolution and experimental procedures are determined. Dissert. Abstr.

N80-12866*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
***SCANNING AFOCAL LASER VELOCIMETER PROJECTION LENS SYSTEM* Patent Application**
David B. Rhodes, *inventor* (to NASA) Filed 7 Sep. 1979 *10 p*
(NASA-Case-LAR-12328-1; US-Patent-Appl-SN-073477) Avail: NTIS HC A02/MF A01 CSCL 20F

A method and apparatus for projecting and focusing parallel laser light beams from a laser Doppler velocimeter on a target *area is presented. The system which includes three lenses is* described. Two lenses work together as a fixed afocal lens combination. The third lens is a movable scanning lens. Parallel *laser beams travel from the velocimeter through the scanning* lens and through the afocal lens combination and converge. The constant focal volume and crossbeam angle which are maintained *during the scan are discussed.* NASA

N80-12867# Boeing Vertol Co., Philadelphia, Pa.
***HELICOPTER CANOPY INTERNAL REFLECTION INVESTIGATION* Final Report, Jul. 1978 - Jan. 1979**
Dino Piccione Jul. 1979 40 p
(Contract DAAK51-78-C-0009; DA Proj. 1L1-62209-AH-76)
(AD-A073084; D210-11494-1; USARTL-TR-79-14) Avail: NTIS HC A03/MF A01 CSCL 01/3

The reflections on helicopter canopies from instrument panel light sources adversely affect night flight operations. A program *objective was to investigate the application of Light Control Film,* such as 3M or equivalent material, as a technique for eliminating helicopter canopy reflections in the AH-1S from instrument panel *lighting which cause the pilot and copilot night flight operational* problems. A mock-up of the AH-1S was used to test and evaluate the reflection conditions. Light control technology was reviewed *to uncover corrective techniques or materials. The most promising* approach was to apply 3M Light Control Film on the face of instruments and control panels. Most reflections were eliminated *using this technique. A few problem areas still remain which* appear to be treatable by applying a soft glare shield extension that enshrouds the cockpit. GRA

N80-12868# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
OPTICAL FRINGE ANALYSIS TECHNIQUES, VOLUME 1 Final Report, 1 Jul. 1975 - 30 Sep. 1978
T. L. Williamson and Charles Richard Lane Jun. 1979 24 p
(AF Proj. 2001)

(AD-A072714; AFAL-TR-79-1115-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17/8

The use of specklegrams for performing certain types of NDI and NDT has been known for some time yet a method for extracting the data quickly and cheaply has eluded specklegram users. This report discusses a new technique for performing the data reduction of the large amounts of data obtained through speckle interferograms. This new technique correlates an optical mask on a fringe pattern to generate a single line scale proportional to the frequency of the cosine fringe pattern when integrated orthogonally to the fringe line. GRA

N80-12868# Air Force Avionics Lab., Wright-Patterson AFB, Ohio

HOLOGRAPHIC SPECTRAL ANALYSIS Final Report, 1 Jul. 1978 - 30 Sep. 1978

T. L. Williamson and Charles Richard Lane Jun. 1979 41 p refs

(AF Proj. 2001)

(AD-A072715; AFAL-TR-79-1115-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report discusses the basic concepts and techniques required to design and use holographic optics for a number of spectral analysis problems. Since an in depth knowledge of the holographic processes is not required to use holographic optics for the various applications, the text is written for simplistic implementation into optical spectral analysis systems. Included in the report is a 9820A calculator ray trace program for aiding in the optical system design. GRA

N80-12870# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ACCURACY OF PARAMETER ESTIMATES FOR CLOSELY SPACED OPTICAL TARGETS Technical Note

Keh-Ping Dunn 13 Jun. 1979 35 p refs

(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)

(AD-A073093; TN-1979-43; ESD-TR-79-152) Avail: NTIS HC A03/MF A01 CSCL 17/8

Cramer-Rao lower bounds on the degradation of measurement precision for closely space optical targets are found. Degradation is more severe than previously thought, especially, for small target separations. The bound obtained by a previous analysis, is, in fact, theoretically identical to the Cramer-Rao bound presented here. The disagreement in results is caused by numerical problems in a computer program used in the previous analysis. GRA

N80-12871# Alabama Univ., University.

THEORETICAL ANALYSIS OF SCATTERING OF A LASER BEAM FROM ROUGH SURFACES Final Report, 15 Dec. 1976 - 31 May 1979

C. C. Sung Jul. 1979 45 p refs

(Contract DAAG29-77-G-0051)

(AD-A073129; ARO-13913.6-P) Avail: NTIS HC A03/MF A01 CSCL 20/6

The accomplishments of the work performed under the support of the grant are summarized. The abstracts of all twelve publications are given in Appendix A. An important part of the effort in the speckle statistics deals with the computation of the probability density function of light received by a finite size detector. This work is included as Appendix B. GRA

N80-12872# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.

LIFETIME PREDICTION FOR OPTICAL GLASS FIBERS Technical Note, 1 Sep. 1978 - 31 Aug. 1979

John E. Ritter, Jr. and Karl Jakus Aug. 1979 30 p refs

(Contract N00014-78-C-0836)

(AD-A072771) Avail: NTIS HC A03/MF A01 CSCL 20/6

The number of test samples used to characterize the crack propagation parameter N of glass and ceramic materials determines the confidence in failure predictions for these materials. A Monte Carlo simulation technique was used to study the effect of sample size on the statistical reproducibility of the fatigue constant N from dynamic fatigue data. It is shown that the statistical variability in N can be large especially for sample sizes of less than 100. It is recommended that before meaningful conclusion can be drawn regarding the effect of a test variable on N as measured from the dynamic fatigue experiment, the statistical reproducibility of N should be evaluated. GRA

N80-12873# California Univ., Livermore. Lawrence Livermore Lab.

TOPS - A TIMING OPTICAL FIBER SYSTEM

D. L. Davis May 1979 14 p refs Presented at 2d Intern. Conf. on Megagauss Magnetic Field Generation and Related Topics, Washington, D. C., 29 May 1979

(Contract W-7405-eng-48)

(UCRL-81973; CONF-790540-5) Avail: NTIS HC A02/MF A01

A technique was established to accurately determine the position of a high velocity liner as it slides past or impinges on another surface. A small diameter optical fiber is accurately positioned relative to a target or liner. A bright light source (such as a small He-Ne laser) illuminates one end. The output from the other end is passed through a bandpass filter to a gated photomultiplier tube. Loss of the light signal thus accurately determines the time and position at which the fiber is broken by a passing liner. This technique is especially useful in environments where the presence of large magnetic fields or large circulating currents make the use of other techniques difficult (e.g., electrical shorting pins). This optical system is completely decoupled from environments having large electromagnetic noise levels. Shock waves in solid materials have been found to turn the fiber opaque during passage so that shock wave time of arrival studies are also feasible using the TOPS system. DOE

N80-12874# California Univ., Livermore. Lawrence Livermore Lab.

BRILLOUIN SCATTER IN A HYDRODYNAMIC SIMULATION

J. Harte, K. Estabrook, and D. Bailey 8 Jun. 1979 15 p refs Presented at 3d Ann. Conf. on Transport Processes in Plasmas, Traverse City, Mich., 18 Jun. 1979

(Contract W-7405-eng-48)

(UCRL-82793; CONF-790675-2) Avail: NTIS HC A02/MF A01

A numerical method for modeling stimulated Brillouin scatter (SBS) in a hydrodynamic simulation code is discussed. Preliminary results using the model show that scattering is reduced as shorter wave lengths are used, and for spherical symmetry, that ion heating by SBS is not significant since the ions cool by expansion. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-12875 Illinois Univ. at Chicago Circle, Chicago.

EIGENVALUE BOUNDS AND STABILITY OF CONSERVATIVE FLUID AND PLASMA FLOWS Ph.D. Thesis

Richard John Lucas 1979 192 p

Avail: Univ. Microfilms Order No. 7925992

The linear stability of several steady plasma and magnetohydrodynamic flows is studied. Circle theorems, which furnish bounds for the complex eigenfrequencies of any normal mode, are obtained for the swirling flow of a compressible, inviscid, perfectly conducting MHD fluid with axial and azimuthal equilibrium magnetic fields. Results for an inviscid compressible fluid are contained as a special case. Circle theorems are obtained for a macroscopic model of a swirling, inviscid, compressible N component plasma immersed in a static magnetic field having both axial and azimuthal components. The stability of plane parallel flow of an inviscid, compressible MHD fluid with a transverse equilibrium magnetic field, and the stability of an N component plasma with a transverse equilibrium magnetic field are discussed. Dissert. Abstr.

N80-12876 Iowa Univ., Iowa City.

NON-MARKOVIAN THEORY OF STRONG TURBULENCE Ph.D. Thesis

Michael Mond 1979 104 p

Avail: Univ. Microfilms Order No. 7924509

Steady state and time dependent statistical properties of quadratical nonlinear model turbulence equations are studied.

The nondissipative equilibrium, derived from the knowledge of the constants of motion which survive the truncation of the Fourier transformed equations, are discussed. Kolmogorov-like dimensional analysis is used in order to obtain the spectral laws for the dissipative forced case. The force acting on each degree of freedom in the turbulent system is split into two parts in the time dependent problem. A dynamical friction force which is nonmarkovian and a random force which has zero ensemble average. The demand that the random force has zero mean provides a procedure for renormalized expansion. The expansion procedure is applied to two cases: (1) two dimensional MHD turbulence. The DIA for this case is derived, and (2) a simple model due to Orszag. Dissert. Abstr.

N80-12877 Wisconsin Univ. - Madison.
CONVECTIVE CELLS AND THEIR RELATIONSHIP TO VORTEX DIFFUSION IN THE WISCONSIN LEVITATED OCTUPOLE Ph.D. Thesis
Alicia Butcher Ehrhardt 1978 210 p
Avail: Univ. Microfilms Order No. 7918886

Nonazimuthally symmetric floating potential structure (also called vortices or convective cells) were examined to determine whether the structure is responsible for enhanced diffusion in the Octupole. Two gun plasma were used: a collisionless H plasma and a collisional He plasma. The floating potential was measured as a function of the coordinates perpendicular to the magnetic field by a Langmuir probe mounted on a cart which could be moved azimuthally along the bottom of the Octupole; the results are presented as two dimensional contour plots. For a purely poloidal field, the floating potential was found to be constant along a magnetic field line, and the two dimensional contours are rotated about one of the internal rings to show the three dimensional potential structure. Dissert. Abstr.

N80-12878 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OSCILLATIONS AND WAVES IN ANISOTROPIC PLASMAS Ph.D. Thesis
Michael D. Arthur 1979 114 p
Avail: Univ. Microfilms Order No. 7924087

The linearized Vlasov-Maxwell equations describing anisotropic plasma oscillations and waves are studied using an operator theoretic approach. The model considered is one dimensional. Existence and uniqueness of the solution to the longitudinal plasma wave boundary value problem is proved by writing the longitudinal equations in operator form and using the theory of semigroups. The solution of the plasma wave boundary value problem is arrived at by a Fourier time transformation of the Vlasov equation coupled to Ampere's Law rather than Gauss' Law, and analyzing a scalar operator. The Wiener-Hopf factorization of the fixed frequency longitudinal plasma dispersion function is presented. The longitudinal plasma wave problem and the coupled nonlinear integral equations for the Wiener-Hopf factors are studied. Dissert. Abstr.

N80-12879 Wisconsin Univ. - Madison.
TURBULENCE MEASUREMENTS BY DIGITAL SPECTRAL ESTIMATION IN THE OHMICALLY HEATED PROTOCLEO TORSATRON Ph.D. Thesis
Thomas Anthony Casper 1979 185 p
Avail: Univ. Microfilms Order No. 7919791

Low frequency fluctuations observed in the ohmically heated plasma of the Proto-Cleo Torsatron are examined. Density fluctuations inferred by ion saturation current of double Langmuir probes were Fourier analyzed using digital signal processing techniques. Results indicate the fluctuations to be of a turbulent nature with no narrow band coherent phenomena observed for frequencies less than 500 kHz. The fluctuations examined are believed to be driven by the ohmic heating current and result in diffusion coefficient estimates consistent with fluctuation induced diffusion. Dissert. Abstr.

N80-12880*# State Univ. of New York at Buffalo. Lab. for Power and Environmental Studies.
EXPERIMENTAL AND THEORETICAL INVESTIGATION FOR THE SUPPRESSION OF THE PLANAR ARC DROP IN THE THERMIONIC CONVERTER Final Report, 1 Jul. 1974 - 15 Apr. 1978
David T. Shaw Apr. 1979 41 p refs
(Grant NsG-7071)
(NASA-CR-159611; LAPES-79-003) Avail: NTIS HC A03/MF A01 CSCL 20I

The possibility of using N2 as a gas additive for the development of thermionic topping generators was investigated. The experiment is described and observations are discussed. The potential of applying microwave power in the interelectrode spacing of the converter as an ion generation source was also assessed. A.R.H.

N80-12881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF DUCT AREA RATIO CHANGES IN THE NASA LEWIS H2-O2 COMBUSTION MHD EXPERIMENT
J. Marlin Smith 1979 12 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-79308; E-264) Avail: NTIS HC A02/MF A01 CSCL 20I

MHD power generation experiments utilizing a cesium-seeded H2-O2 working fluid were carried out using a diverging area Hall duct having an entrance Mach number of 2. The experiments were conducted in a high field strength cryomagnet facility at field strengths up to 5 tesla. The effects of power takeoff location, generator loading B field strength, and electrode breakdown voltage were investigated. The effect of area ratio, multiple loading of the duct, and duct location within the magnetic field are considered. R.C.T.

N80-12882# Argonne National Lab., Ill. Engineering Div.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Final Report, Oct. 1977 - Sep. 1978
M. Petrick, G. Fabris, E. S. Pierson, A. K. Fischer, and C. E. Johnson Apr. 1979 214 p refs
(Contract N00014-78-F-0004)
(AD-A073128; ANL/MHD-79-1) Avail: NTIS HC A10/MF A01 CSCL 20/9

The experimental results presented herein satisfy one major goal in demonstrating the technical feasibility of two-phase LMMHD (liquid-metal MHD), i.e., operating an MHD generator at power densities equal to or above that anticipated for practical power systems. Power densities of up to 32 MWe/m(3) and efficiencies higher than 0.6 at high void fractions were attained for a small 20 kWe generator. Slip ratio data, and more extensive pressure distribution and voltage profile data are also given. Barium has been identified as an attractive additive for the generation of foams with NaK, and bismuth is a back-up for barium. A guiding hypothesis for understanding the phenomena contributing to foamability in liquid metal systems has been developed, and basic data on surface tension obtained. GRA

N80-12883# California Univ., San Diego, La Jolla.
SPECIFICATION OF THE NATURAL PLASMA ENVIRONMENT AT GEOSYNCHRONOUS ORBIT Final Report, 1 Oct. 1977 - 30 Sep. 1978
Sherman E. Deforest and E. C. Whipple Hanscom AFB, Mass. AFGL 10 Dec. 1978 32 p
(Contract F19628-77-C-0014; AF Proj. 7661)
(AD-A073160; AFGL-TR-79-0060) Avail: NTIS HC A03/MF A01 CSCL 20/9

This work has made extensive use of data taken by instruments funded by NASA contracts NAS 5-10364 (ATS-5) and NAS 5-21055 (ATS-6). Much use has been made of software also developed under the same contracts. The present contract was negotiated as a result of the realization that the UCSD plasma instruments onboard the ATS spacecraft could be used to specify an environmental model which would be of use to the Air Force in developing design specifications for spacecraft to prevent faulty operation due to environmentally induced electrostatic charging. In addition, reorganization and study of the existing data would also be of use in developing models which could be of use in predicting times when hazards to spacecraft from charging might be great. Within the next year, SCATHA will make the first observations from a vehicle specifically designed to study charging at geosynchronous orbit. We expect that refinements to the data presented here will result from that program, and that new models will result. GRA

N80-12884# Princeton Univ., N. J.
TEARING MODES IN A PLASMA WITH MAGNETIC BRAIDING
P. K. Kaw, E. J. Valeo, and P. H. Rutherford Jul. 1979 18 p refs
(Contract EY-76-C-02-3073)
(PPPL-1561) Avail: NTIS HC A02/MF A01

Certain linear and nonlinear properties of macroscopic tearing modes driven by anomalous electron viscosity effects associated with magnetic braiding are examined. Strong linear growth of m = 1, 2 tearing modes (respectively proportional to micron/sup 1/5/ and micron/sup 1/3/) which can occur for rather modest values of micron are discussed. In the nonlinear phase, the island width grows in time as t/sup 1/3/. Speculations regarding the disruptive instability in Tokamaks are investigated. DOE

N80-12885# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTS ON THE ZT-S REVERSED-FIELD PINCH, AUGUST - DECEMBER 1978
A. R. Jacobson Jun. 1979 42 p refs
(Contract W-7405-eng-36)
(LA-7862-MS) Avail: NTIS HC A03/MF A01

The ZT-S reversed field pinch was used to explore the utility of pitch programming techniques in setting up stable diffuse pinch profiles. Experimental observations relating to this goal are presented. DOE

N80-12886# California Univ., Livermore. Lawrence Livermore Lab.
TANDEM MIRROR FUSION REACTOR STUDIES Status Report
G. A. Carlson, R. S. Devoto, J. L. Erickson, J. H. Fink, B. G. Logan, and W. S. Neef, Jr. 15 Nov. 1978 37 p refs
(Contract W-7405-eng-48)
(UCID-17990) Avail: NTIS HC A03/MF A01

A preliminary design study of a 1000 MWe tandem mirror fusion reactor is discussed. Work on the reactor concept including development of a more detailed computer model for tandem mirror physics, the investigation of possible routes to higher Q tandem mirror reactors, design of less expensive central cells for tandem mirror reactors, and component design for the 1 MeV neutral beam injectors required for the end cells is described. DOE

N80-12887# Science Applications, Inc., La Jolla, Calif. Lab. for Applied Plasma Studies.
TRANSPORT AND RADIATION STUDIES OF BELT PINCHES AND HIGH-BETA TOKAMAKS
R. N. Byrne and C. K. Chyu Nov. 1978 24 p refs
(Contract EY-76-C-03-1028)
(SAI-78-964-LJ; LAPS-47) Avail: NTIS HC A02/MF A01

Transport and radiation studies are performed for 2 to 1 radio elliptical cross section plasmas, using the toroidal geometry diffusion code G2M. The Torus 1 and 2 machines are used as models. Two types of profiles are studied: parobolic density and temperature distributions, and force free current profiles, with density peaked near the center and temperature almost flat. DOE

N80-12888# Princeton Univ., N. J. Plasma Physics Lab.
VOLT-SECOND CONSUMPTION DURING THE STARTUP PHASE OF A LARGE TOKAMAK
R. J. Hawryluk and K. Bol Jan. 1979 14 p refs
(Contract EY-76-C-02-3073)
(PPPL-1508) Avail: NTIS HC A02/MF A01

The volt-second consumption in the PLT Tokamak was measured. The volt-second consumption was determined primarily by the external and internal flux required to establish the current profile during the startup phase. The resistive volt-second loss on axis is discussed. DOE

N80-12889# Los Alamos Scientific Lab., N. Mex.
PROPOSAL FOR THE THEORETICAL INVESTIGATION OF THE RELATIVISTIC BEAM-PLASMA INTERACTION WITH APPLICATION TO THE PROOF-OF-PRINCIPLE ELECTRON BEAM-HEATED LINEAR SOLENOIDAL REACTOR
L. E. Thode Sep. 1978 21 p refs
(Contract W-7405-eng-36)
(LA-7359-P) Avail: NTIS HC A02/MF A01

A 36-month program to study the linear relativistic electron beam-plasma interaction is proposed which includes direct support for 1- and 3-m beam-plasma interaction experiments and development of theory relevant for design of a 10-m proof-of-principle electron beam-driven linear solenoidal reactor. DOE

N80-12890# Los Alamos Scientific Lab., N. Mex.
MULTIPLE-MIRROR AXIAL CONFINEMENT USING THE FLUID MODEL
Gurthrie Miller Dec. 1978 14 p refs
(Contract W-7405-eng-36)
(LA-7580-MS) Avail: NTIS HC A02/MF A01

Axial plasma flow through a multiple mirror is calculated using the fluid equations with classical transport. The validity limits are discussed and an attempt is made to extend them. The results are compared with results in the literature. DOE

N80-12891# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
CHARACTERIZATION OF MICROCHANNEL PLATE PHOTOMULTIPLIERS FOR PLASMA DIAGNOSTICS
L. P. Hocker, P. A. Zagarino, J. Madrid (EG&G, Inc., Las Vegas, Nev.), D. Simmons (EG&G, Inc., Las Vegas, Nev.), B. Davis (EG&G, Inc., Las Vegas, Nev.), and P. B. Lyons 1978 8 p refs Presented at IEEE Nuclear Sci. Symp., Washington, D.C., 18 Oct. 1978
(S-129-TP; CONF-781033-4) Avail: NTIS HC A02/MF A01

Properties of four types of microchannel plate photomultipliers were studied, with emphasis on applications to plasma diagnostic experiments. Detector pulse shapes, peak linear currents, pulse rate effects, and ionic feedback effects are documented. Minimum FWHM of 210 ps was observed. Peak linear currents up to 11 A are included. DOE

N80-12892# California Univ., Livermore. Lawrence Livermore Lab.
SUPERCONDUCTING MAGNETS FOR MIRROR MACHINES
G. A. Carlson 12 Sep. 1978 16 p refs Presented at Driven Magnetic Fusion Reactors, Erice, Italy, 18 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81578; CONF-780946-4) Avail: NTIS HC A02/MF A01

The simple mirror configuration, consisting of a long solenoid with increased field strength at the ends (magnetic mirrors), proved to be an unstable plasma container and was replaced by the minimum absolute value of B mirror configuration. The Yin-Yang minimum absolute value of B coil was chosen for the mirror fusion test facility experiment and recent conceptual designs of standard mirror reactors. For the multicell field-reversed mirror reactor concept, to the long solenoid configuration, augmented by normal copper mirror coils and Ioffe bars were placed at the first wall radius to provide a shallow magnetic well for each field-reversed plasma layer. The central cell of the tandem mirror is also a long solenoid while the end plug cells require a minimum absolute value of B configuration. DOE

N80-12893# Battelle Pacific Northwest Labs., Richland, Wash.
SAFETY ASPECTS OF ACTIVATION PRODUCTS IN A COMPACT TOKAMAK FUSION POWER PLANT
H. J. Willenberg and W. E. Bickford Oct. 1978 119 p refs
(Contract EY-76-C-06-1830)
(PNL-2823) Avail: NTIS HC A06/MF A01

Neutron activation of materials in a compact Tokamak fusion reactor was investigated. Results of activation product inventory, dose rate, and decay heat calculations in the blanket and injectors are presented for a reactor design with stainless steel structures. Routine transport of activated materials into the plasma and vacuum systems is discussed. Accidental release of radioactive materials as a result of liquid lithium spills is also considered. DOE

N80-12894# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR THE MAGNETOHYDRODYNAMIC GENERATOR CHANNEL CODE, MHDCHN
A. J. Russo Jan. 1979 52 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1260) Avail: NTIS HC A04/MF A01

A two-dimensional steady state MHD generator channel code was developed to solve for the electric current density and potential field in a channel section. It was designed to operate with a companion fluid code, SCF, which supplies thermodynamic and velocity data as input; however, it may also be used independently or made to interact with other fluid codes. The program is currently operational on the CDC 6600-7600 computer system. The equations that are solved and the input and output data that are required for operation of the code are described. DOE

N80-12895# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPING MAINTAINABILITY FOR TOKAMAK FUSION POWER SYSTEMS, PHASE 2 REPORT. VOLUME 2: STUDY RESULTS
G. M. Fuller, H. S. Zahn, H. C. Mantz, G. R. Kaletta, L. M. Waganer, L. A. Carosella, and J. L. Conlee Nov. 1978 386 p refs
(Contract EG-77-C-02-4184)
(COO-4184-6-Vol-2) Avail: NTIS HC A17/MF A01

The impact of unscheduled maintenance, several vacuum wall arrangements, and maintenance of other reactor interfacing subsystems and maintenance equipment are added to the evaluation of the maintainability of the fusion power reactor concepts. Four concepts are normalized to common performance parameters and evaluated for their capability to achieve availability and cost of electricity goals considering both scheduled and unscheduled maintenance. The results of this evaluation are used to generate a series of maintainability design guidelines and to select the more desirable features and design options which are used to configure a preliminary reactor concept having improved maintainability. DOE

N80-12896# General Atomic Co., San Diego, Calif.
THERMAL-HYDRAULIC CONSIDERATIONS IN MAGNETICALLY CONFINED FUSION REACTORS
D. W. Kearney Jan. 1979 15 p refs Presented at Intern. Conf. on Structural Mech. in Reactor Tech., Berlin, 13 Aug. 1979
(Contract EY-76-C-03-0167)
(GA-A-15365; CONF-790802-13) Avail: NTIS HC A02/MF A01

The structural-related thermal problems that have developed from work on the Tokamak and mirror concepts were studied, though many of the important considerations are generic to all magnetic fusion systems. The thermal loads due to alpha particle energy deposition on the first wall, and the energy deposited by neutron interaction as volumetric heating, place substantial cooling requirements on many components of a fusion reactor, e.g., coils, blankets, shields and first walls. The high temperature region in close proximity to the plasma are discussed. Heat fluxes, temperatures and temperature fluctuation are highest in these components, possibly leading to creep rupture and thermal fatigue. Some of the design solutions and thermal-hydraulic results presented in recent fusion reactor conceptual design studies are discussed. DOE

N80-12897# Argonne National Lab., Ill. Chemical Engineering Div.
CURRENT STATUS OF FUSION REACTOR BLANKET THERMODYNAMICS
E. Veleckis, R. M. Yonco, and V. A. Maroni Apr. 1979 34 p refs
(Contract W-31-109-eng-38)
(ANL-78-109) Avail: NTIS HC A03/MF A01

Recent studies of liquid lithium have concentrated on its sorption characteristics for hydrogen isotopes and its interaction with common impurity elements. Hydrogen isotope sorption data (P-C-T relations, activity coefficients, Sieverts' constants, plateau pressures, isotope effects, free energies of formation, phase boundaries etc.) are presented in a tabular form that can be conveniently used to extract thermodynamic information for the alpha phase of the Li-LiH, Li-LiD, and Li-LiT systems and to construct complete phase diagrams. Recent solubility data for Li3N, Li2O, and Li2C2 in liquid lithium are discussed with emphasis on the prospects for removing these species by cold-trapping methods. Current studies on the sorption of hydrogen in solid lithium alloys (e.g., Li-Al and Li-Pb), made using a new technique (the hydrogen titration method), have shown that these alloys should lead to smaller blanket-tritium inventories than are attainable with liquid lithium and that the P-C-T relationships for hydrogen in Li-M alloys can be estimated from lithium activity data for these alloys. DOE

N80-12898# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
CONCEPTUAL DESIGN OF A DEMONSTRATION TOKAMAK HYBRID REACTOR (DTHR)
J. L. Kelley Dec. 1978 195 p refs
(Contract EG-77-C-02-4544)
(WFPS-TME-107) Avail: NTIS HC A08/MF A01

The flexibility of the fusion hybrid reactor to function as a fuel production facility, power plant, waste disposal burner or combinations of all of these, as well as the reactor's ability to use proliferation resistant fuel cycles, has provided the incentive to assess the feasibility of a near-term demonstration plant. The goals for a Demonstration Tokamak Hybrid Reactor (DTHR) were established and an initial conceptual design was selected. Reactor performance and economics were evaluated and key developmental issues were assessed. The study has shown that a DTHR is feasible in the late 1980's, a significant quantity of fissile fuel could be produced from fertile thorium using present day fission reactor blanket technology, and a large number of commercially prototypical components and systems could be developed and operationally verified. The DTHR concept would not only serve as proof-of-principle for hybrid technology, but could be operated in the ignited mode and provide major advancements for pure fusion technology. DOE

N80-12899# Department of Energy, Washington, D. C.
MAGNETIC FUSION THEORY EFFORT
May 1979 104 p refs
(DOE/ET-0099) Avail: NTIS HC A06/MF A01

A comprehensive listing of the magnetic fusion theory effort is presented. Data on the FY 1977 and FY 1978 budgets are given. Approximately 34 entries are reported along with a section devoted to the National Magnetic Fusion Computer Center. DOE

N80-12900# California Univ., Livermore. Lawrence Livermore Lab.
SEARCH FOR FUSION POWER
R. F. Post 12 Oct. 1978 16 p
(Contract W-7405-eng-48)
(UCRL-81890) Avail: NTIS HC A02/MF A01

The basics of fusion power are reviewed. Both inertial confinement and magnetic confinement fusion are discussed. DOE

N80-12901# Oak Ridge National Lab., Tenn.
RESPONSE OF A TOKAMAK PLASMA TO PARTICLE AND MOMENTUM SOURCES
W. M. Stacey, Jr. and D. J. Sigmar Dec. 1978 47 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6575) Avail: NTIS HC A03/MF A01

The response of an axisymmetric toroidal Tokamak plasma to first-order particle and momentum sources is investigated. The momentum sources which drive coupled poloidal and toroidal mass flows and electrostatic field evolution are examined. Transport fluxes which are driven across flux surfaces both by interspecies collisional momentum exchange, and by momentum exchange between the plasma and external sources and/or drags are discussed. A generalized Ohm's law is obtained and used to determine the manner in which particle and momentum sources can drive parallel currents and can alter the evolution of the q-profile. The theory is formulated for arbitrary plasma cross sections, beta, and collision regimes. DOE

N80-12902# California Univ., Livermore. Lawrence Livermore Lab.
RADIAL DIFFUSION OF RESONANT PARTICLES IN TANDEM MIRRORS
Y. C. Lee 4 Dec. 1978 29 p refs
(Contract W-7405-eng-48)
(UCID-17992) Avail: NTIS HC A03/MF A01 .

The radial diffusion of resonant particles in the banana regime and the plateau regime is derived in detail from kinetic theory.

The plateau diffusion, calculated in the tau approximation, is discussed in relation to the result given by Ryutov-Stupalov. The banana diffusion which agrees with the R-S result provided the latter is corrected for some dependence of the collision frequency on epsilon and phi is examined. DOE

N80-12903# California Univ., Livermore. Lawrence Livermore Lab.
STATISTICAL MECHANICS OF REACTING DENSE PLASMAS
F. J. Rogers 22 Nov. 1978 23 p refs Presented at the Conf. on Dense Plasmas, Pasadena, Calif., 14-16 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81936; CONF-781189-1) Avail: NTIS HC A02/MF A01

The quantum statistical theory of strongly coupled many component plasmas is reviewed. The theoretical development is shown to consist of six separate parts. Compensation between bound and scattering state contributions to the partition function and use of the shifted Debye energy levels are discussed. DOE

N80-12904# Princeton Univ., N. J. Plasma Physics Lab.
SYSTEMS STUDY OF TOKAMAK FUSION-FISSION REACTORS
F. H. Tenney, C. G. Bathke, W. G. Price, Jr., W. H. Bohlke, R. G. Mills, E. F. Johnson, A. M. M. Todd, C. H. Buchanan, and S. L. Gralnick Nov. 1978 549 p refs
(Contract EY-76-C-02-3073)
(PPPL-1450) Avail: NTIS HC A23/MF A01

A systematic analysis of wide variety of Tokamak driven fissioning blanket reactors is presented. The quantitative problems of determining the economically most desirable mix of the two products: electric power and fissionable fuel are addressed. An optimizing algorithm that operates in a six dimensional parameter spece is described. Comparisons made on sets of as many as 100,000 distinct machine models, and the principal results of the study derived from the examination of several hundred thousand possible reactor configurations are presented. DOE

N80-12905# Columbia Univ., New York. School of Engineering and Applied Science.
THERMONUCLEAR BURN IN WALL-CONFINED PLASMAS
L. N. Kmetyk 1979 151 p refs
(Contract EY-76-S-02-2456)
(COO-2456-60) Avail: NTIS HC A08/MF A01

The one dimensional initial value problem describing a hot, dense, thermonuclear reacting plasma which is magnetically insulated and contained between cold metal walls was studied by means of computational simulation. The resulting time evolution of the plasma temperature, number density and magnetic field profiles includes the effects of thermal conduction and radiation energy losses from the plasma, convection, and a detailed treatment of alpha particle heating, as well as ohmic heating and magnetic field diffusion. The results are used to evaluate the net energy gains possible in shock heated, magnetically insulated, well confined fusion cycle. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-12906 Wisconsin Univ. - Madison.
THE TRANSPORT PROPERTIES OF DILUTE GASES IN APPLIED FIELDS Ph.D. Thesis
James Arthur Thomas 1978 196 p
Avail: Univ. Microfilms Order No. 7918166

The difficulties inherent in treating diatom-diatom interactions lead to consideration of binary gaseous mixtures in which the dominant species is atomic, the diatomic species being restricted to low concentrations. Such systems require consideration of atom-atom and atom-diatom interactions only. Employing methods introduced by Hunter, scalar equations are obtained for the transport properties of binary mixtures in applied magnetic fields. The shear viscosity of an atom-diatom mixture in an applied magnetic field is then treated in detail. The basis set is truncated and the diatomic species is restricted to low concentrations. The expressions obtained for the shear viscosity tensor are reported. Steps leading to calculation of the shear viscosity tensor in this particular case are discussed. Dissert. Abstr.

N80-12907 Iowa State Univ. of Science and Technology, Ames.
THE CRYSTAL AND MOLECULAR STRUCTURE OF SOME HIGH COORDINATION RARE EARTH COMPOUNDS, THE MAGNETIC AND STRUCTURAL PROPERTIES OF SOME RARE-EARTH-TRANSITION-METAL COMPOUNDS, AND USE OF RADIAL DISTRIBUTION FUNCTIONS IN STRUCTURAL ANALYSIS Ph.D. Thesis
Charles Curtis Fuller 1979 190 p
Avail: Univ. Microfilms Order No. 7924241

The crystal and molecular structures of two decacoordinate rare earth compounds, lanthanum HEDTA and praseodymium nitrate, are investigated. A discussion of decacoordination is given. The crystal and magnetic properties of three classes of ternary rare earth alloys, RMn4Al8, RFe4Al8, and RCu4Al8, are discussed. X-ray and neutron diffraction experiments are described, as well as magnetic susceptibility measurements. The use of radial distribution functions as a tool in structural analysis is investigated, using niobium hydride and lutetium hydride structures as an example. When coupled with neutron diffraction, this technique is shown to be useful in determination of the hydrogen positions. Dissert. Abstr.

N80-12908 Clarkson Coll. of Technology, Potsdam, N.Y.
STUDIES IN SURFACE STRUCTURE BY MEANS OF SURFACE VISCOSITY Ph.D. Thesis
Dennis Wayne Goupil 1979 178 p
Avail: Univ. Microfilms Order No. 7923695

The research involves two applications of the Goodrich viscometer. The interfacial conformations of a polypeptide were investigated with the hope that surface shear viscosity can provide a diagnostic tool for differentiating in situ between various confermers. The behavior of a fatty acid at the oil/water interface as the pH of the aqueous phase is altered is illustrated. Dissert. Abstr.

N80-12909 City Univ. of New York, N. Y.
EFFECTS OF UNIAXIAL STRESS ON EXCITONS IN CUPROUS OXIDE Ph.D. Thesis
Robert George Waters 1979 177 p
Avail: Univ. Microfilms Order No. 7923777

The effects of uniaxial stress on several exciton states in cuprous oxide were studied. The experiments, which were performed using oriented single crystal samples, utilized the resonant Raman scattering spectroscopic technique. This method identifies quadrupole allowed exciton states by the enhancement in the Raman cross section for normally forbidden scattering from odd parity phonons. Three S (L=0) exciton states and one D (L=2) state were studied using stresses of two different symmetries. The results of the experiments are analyzed and compared with theoretical predictions. Dissert. Abstr.

N80-12910 Utah Univ., Salt Lake City.
HYDROSTATIC PRESSURE EFFECTS ON THE MOTIONAL BEHAVIOR OF MOLECULES AND IONS IN ALKALI HALIDES, ALKALI CYANIDES AND BETA-ALUMINA Ph.D. Thesis
Klaus Thoermer 1979 167 p
Avail: Univ. Microfilms Order No. 7925044

Lattice compression by hydrostatic pressure was applied to study the motional behavior of ions and molecules in solids, using dielectric and optical techniques. Two simple model systems with dilute noninteracting dipole defects were investigated here: Li(+) in RbCl - a test-case for the theory - was shown to be an off center defect, displaying a strong decrease of potential barriers and relaxation time under lattice compression. An extensive study in the effects of pressure on the rotation of dilute OH(-) molecules in eight alkali-halide hosts was conducted. Two complex systems, in which interaction effects cannot be neglected or are predominant, were studied using similar concepts and techniques: The motional behavior of Li(+), Na(+), K(+),Ag(+), and H3O(+) ions in the superionic conductor beta alumina was investigated under fields applied perpendicular to

the conduction planes. The collective ordering of CN(-) molecules in KCN mixed with KCl and KBr was studied under pressure by monitoring with laser light the onset of light scattering from domains at the ferroelastic phase transition. Dissert. Abstr.

NBD-12911 Columbia Univ., New York.
A STUDY OF THE OPTICAL AND TRANSPORT PROPERTIES OF THE TERNARY SEMICONDUCTING COMPOUNDS AlxGa1-xAs HIGH PRESSURE Ph.D. Thesis
Nadezhda Lifshitz 1979 166 p
Avail: Univ. Microfilms Order No. 7924931

An investigation on the effect of hydrostatic pressure as well as composition on the electronic band structure and transport properties of the compound semiconductor Al sub x Ga sub 1-xAs is discussed. The results are discussed using models appropriate for the situation. The actual experiments were (1) optical absorption measurements on Al sub x Ga sub 1-xAs samples as a function of pressure, (2) Hall effect and resistivity measurements to 40 kbar pressure at temperature in the range 150 K to 300 K. These measurements provided experimental data from which the direct energy gap pressure coefficient and also the Hall coefficient and Hall mobility variation with pressure, temperature and composition were determined. Dissert. Abstr.

NBD-12912 New York Univ., N. Y.
LATTICE AND ELECTRONIC PROPERTIES OF THE HIGH TEMPERATURE SUPERCONDUCTOR VANADIUM SILICIDE Ph.D. Thesis
Marvin Milewits 1979 218 p
Avail: Univ. Microfilms Order No. 7925495

The anomalous temperature dependencies of the transport and thermodynamic properties of the A-15's are explored via measurements of electrical resistivity, thermal expansion, and neutron scattering. High precision measurements of electrical resistivity coupled with highly sensitive thermal expansion and moderately precise thermal neutron scattering measurements on various single crystals of V3Si which reveal unknown characteristics are discussed. The electrical resistivity rho (T) of V3Si as well as the other A-15 compounds Nb3Sn and Nb3Sb are characterized by the sum of a linear and a dominant exponential term over a wide range in temperature. Dissert. Abstr.

NBD-12913 Brandeis Univ., Waltham, Mass.
MOMENTUM DENSITY MEASUREMENTS IN Cu AND ALPHA-PHASE Cu-Zn ALLOYS WITH A MULTI-COUNTER TWO-DIMENSIONAL ANGULAR CORRELATION OF ANNIHILATION RADIATION APPARATUS Ph.D. Thesis
Mohammed Haghgooie 1979 161 p
Avail: Univ. Microfilms Order No. 7925708

A multicounter point slit apparatus with 0.5 mrad by 1.5 mrad slit openings was used to measure two dimensional angular correlation of annihilation radiation (2D-ACAR) surfaces from oriented crystals of pure Cu, Cu-11.6 at.% Zn and Cu-30 at.% Zn alloys. The experimental results from three orientations of the Cu crystal reveal the known topology of the Cu Fermi surface. The alloy surfaces are quite similar in shape to the corresponding results in Cu; however, they show a clear increase in the size of the Fermi surface. The 2D-ACAR surfaces at large momenta reveal marked anisotropies which are believed to be due to the high momentum components of the positron and conduction electrons wave functions. The comparison of the first derivative curves from pure Cu and disordered Cu-Zn alloys indicates that the FS smearing in the alloys due to randomness is less than 3% even for the Cu-30 at.% Zn alloy. Dissert. Abstr.

NBD-12914 California Univ., Riverside.
STUDIES OF HOPPING AND CORRELATED HOPPING IN P-TYPE GERMANIUM BY PIEZO-MAGNETO-RESISTANCE MEASUREMENTS Ph.D. Thesis
Ching-Long Jiang 1979 90 p
Avail: Univ. Microfilms Order No. 7924286

Hopping conductivity in p-type germanium was measured as a function of magnetic field H, temperature T, tensile and compressive stress X, and acceptor concentration. A model was proposed to explain the features of the results. In this model, the acceptor consists of two wave functions with different anisotropies and similar radii which are degenerate at X = 0 and gradually split at a finite stress. In the low and intermediate stress regimes, the main effect of stress is to split the wave functions, while that of the magnetic field is to modify the size of the wave functions. In the high stress regime, the effect of stress on the size of the wave functions is important. Correlated hopping was proposed to be the mechanism which dominates transport at high stress and/or at high impurity concentrations. Dissert. Abstr.

NBD-12915 Columbia Univ., New York.
VERY SHALLOW P-N JUNCTIONS WITH BORON-RICH LAYERS AND APPLICATIONS AS HIGH EFFICIENCY P+/N PHOTOVOLTAIC JUNCTIONS Ph.D. Thesis
Myung Seung Bae 1979 83 p
Avail: Univ. Microfilms Order No. 7924848

A boron diffusion process is described for the fabrication of a very shallow p+ diffused layer in silicon with a very high surface concentration. The diffused layers and the thin boron rich layers which form during this diffusion process were studied by auger electron spectroscopy, secondary ion mass spectrometry, low energy electron diffraction, reflection high energy electron diffraction, and reflection X-ray topography. It was demonstrated for the first time that very efficient photovoltaic devices of p+/n structure can be made by this process with AMI efficiency of greater than 17%. By retaining a thin boron rich layer, it was possible to lower the lateral series resistance of the very shallow diffused layer and also to passivate the bare surface of silicon. Dissert. Abstr.

NBD-12916 Illinois Univ. at Chicago Circle, Chicago.
LOW TEMPERATURE SPECIFIC HEAT OF NICKEL-COPPER ALLOYS IN VARIOUS MAGNETIC FIELDS Ph.D. Thesis
Robert George Aitken 1979 172 p
Avail: Univ. Microfilms Order No. 7925988

The specific heat of three Ni-Cu alloys (40, 43, & 45 at.% Ni) in applied magnetic fields of 10, 20, 30, and 42 kOe, as well as in zero field, was measured over the temperature range from 1.2 to 12 K. The anomalous magnetic term in the specific heat of these alloys, is found to be due to dilute concentrations of paramagnetic clusters with giant magnetic moments. The values obtained for the coefficient of the electronic term in the specific heat are considerably higher than the known value for pure copper, indicating that the itinerant-electron rigid band model is not correct. The magnetic term in the specific heat was found to vary linearly with temperature at the lowest temperatures, which is considered to be characteristic of a spin-glass-like distribution of internal fields within the material. It appears that the internal field distribution in Ni-Cu is basically the same on both sides of the critical composition for ferromagnetism. Dissert. Abstr.

NBD-12917 Pittsburgh Univ., Pa.
SINGLE CRYSTAL DEFECT STUDIES BY MEANS OF ION CHANNELING Ph.D. Thesis
Jeng Hsien Chang 1979 100 p
Avail: Univ. Microfilms Order No. 7924650

The efficacy of Rutherford Backscattering and Channeling in elucidating the nature of radiation induced defects and strain incuded structural defects in single crystals of metals and semiconductors was explored. A reveiw is given of the basic theories of channeling followed by a description of the apparatus. Experimental procedures are outlined in detail. Case studies are presented for radiation damaged Mo and epitaxial layers of Si grown on sapphire substrates. Within the very serious limitations of presently available theory the experimental results were analyzed. Dissert. Abstr.

NBD-12918 Stevens Inst. of Tech., Hoboken, N. J.
AN X-RAY DIFFRACTION STUDY OF THE THERMAL VIBRATION OF ATOMS IN BETA-TIN Ph.D. Thesis
Berton Laurence Greenberg 1979 169 p
Avail: Univ. Microfilms Order No. 7925050

An expression for the temperature factor, exp(-W) of Beta-tin was calculated using the independent anharmonic oscillator model of thermal motion. The result confirms previous analyses and extends them to include fourth order terms in the atomic potential energy. Anharmonic effects were experimentally observed. These include tentative observations of centric anharmonic components of thermal motion in certain crystallographic

directions. Controversial space group forbidden reflections were observed. Their presence could be explained on the basis of simultaneous reflection effects. Anomalously low values of less than u squared greater than were observed in a room temperature experiment and in an intensity versus temperature experiment. In the former case the effect was explained on the basis of secondary extinction and in the latter on the basis of an unusual configuration of seven simultaneous reflections.
Dissert. Abstr.

N80-12919 Michigan Univ., Ann Arbor.
EXCITONS, PHONONS, AND ENERGY TRANSPORT IN MIXED NAPHTHALENE CRYSTALS: PERCOLATION OR ANDERSON LOCALIZATION Ph.D. Thesis
David Cutler Ahlgren 1979 211 p
Avail: Univ. Microfilms Order No. 7925100

The phonons and vibrational exciton bands in the far infrared spectrum of isotopic mixed naphthalene crystals are studied. The validity of the amalgamation limit for lattice modes (phonons) and the separated band limit for vibrational excitons are investigated. Heavily doped isotopic mixed naphthalene crystals were used to verify exciton splitting for the lowest energy in naphthalene. Results are compared with coherent potential approximation calculations. Phonon sidebands are identified and a comparison is made with the one phonon density of states of naphthalene. Exciton-phonon interactions are discussed and the exciton-phonon coupling in the naphthalene 0-0 phosphorescence and its phonon sideband is reported and compared to the exciton-phonon coupling in fluorescence. Dissert. Abstr.

N80-12920 Michigan Univ., Ann Arbor.
COHERENCE STUDIES IN THE FIRST ELECTRONIC EXCITED SINGLET STATE OF SOLID NAPHTHALENE Ph.D. Thesis
Panayiotis Argyrakis 1979 234 p
Avail: Univ. Microfilms Order No. 7924839

An energy transfer model is proposed that describes the exciton migration in the naphthalene system at 1.8 K. The problem is treated in a twofold manner: A Monte Carlo simulation process is employed in which a binary crystal lattice is generated and kept in the computer memory with all the physical parameters of our experimental system. Several types of random motion are treated on this lattice. Exciton-phonon scattering is included via a phenomenological parameter and impurity or defect trapping was accounted for in the choice of our system. The important parameter tested is the coherence length, 1, the length in lattice units over which the excitation memory is perfectly retained. Dissert. Abstr.

N80-12921 New York Univ., N. Y.
EXCITON DYNAMICS IN ALPHA-PARTICLE TRACKS IN ORGANIC CRYSTALS: MAGNETIC FIELD STUDY OF THE SCINTILLATION IN ANTHRACENE AND TETRACENE CRYSTALS Ph.D. Thesis
Michael Binder 1979 129 p
Avail: Univ. Microfilms Order No. 7925441

The scintillation mechanism in organic crystals bombarded by alpha particles are discussed in terms of current knowledge of exciton dynamics derived from a study of the photofluorescence of anthracene and tetracene. The scintillation of tetracene excited by 4.4 MeV alpha particles incident perpendicular to the ab plane was studied in the presence of external magnetic fields and compared to the scintillation of crystalline anthracene. Using appropriate equations, expressions are derived for the prompt and delayed components of the total scintillation yield. Nanosecond time resolved magnetic field effects on the alpha-particle induced scintillation in anthracene, tetracene doped anthracene and anthracene crystals containing high densities of induced paramagnetic quenching centers is presented. A simple kinetic picture for triplet exciton motion consistent with current knowledge of triplet exciton dynamics is discussed. Dissert. Abstr.

N80-12922 Vermont Univ. and State Agricultural Coll., Burlington.
ELECTRON CONDUCTIVITY MOBILITY IN SEMICONDUCTORS BASED ON A DIELECTRIC FUNCTION MODIFICATION OF THE DINGLE IMPURITY ION POTENTIAL Ph.D. Thesis
Ulanda Mae Richardson 1979 210 p
Avail: Univ. Microfilms Order No. 7925313

The Brooks-Herring theory of ionized impurity scattering in semiconductors incorporating a more accurate description of dispersive valance screening in the scattering potential. Because of the form of the spatial dielectric function, defined as the ratio of the unscreened to screened impurity ion potential, it is postulated that the improved potential should equal the usual single screened Coulomb potential multiplied by a correction factor which would equal unity at large distances from the ion. Several methods of achieving such a potential are discussed. It is concluded that an entirely numerical approach, such as the method of finite differences, provides the most accurate and most efficient means of solution of the requisite differential equation. To gauge the effect of this potential upon transport properties, a calculation of the electron conductivity mobility, in the first Born approximation, is made. Dissert. Abstr.

N80-12923 Stevens Inst. of Tech., Hoboken, N. J.
ORDER PARAMETER RELAXATION AND ANOMALOUS CONDUCTIVITY IN SUPERCONDUCTING TIN Ph.D. Thesis
A. John Ritger 1979 189 p
Avail: Univ. Microfilms Order No. 7925057

The order parameter relaxation time tau sub R, the time required for the density of Cooper pairs to achieve equilibrium with a change in current density, was measured using one dimensional samples of tin. An anomalous excess conductivity was discovered and characterized. The calculations and results are presented and discussed. Dissert. Abstr.

N80-12924 State Univ. of New York at Albany.
Na BETA-ALUMINA: STRUCTURE ANALYSIS OF A SUPERIONIC CONDUCTOR Ph.D. Thesis
Franz Reidinger 1979 165 p
Avail: Univ. Microfilms Order No. 7925082

The conduction mechanism in Na beta alumina and the establishment of a relation between the structure and the composition of this compound is discussed. Neutron diffraction data were collected from a single crystal in a high flux beam reactor. They were analyzed together with already existing data on Na, Ag and (H3O(+),H(+)) beta alumina, K and Ba ferrite, calcia hexaluminate and magnesia stabilized Na beta sub 1 alumina. These structures, which have in common a four layered spinel block, are discussed. They are divided into two groups, the magneto plumbites and the beta aluminas, by a difference in the density of the interconnecting layer, while two forms of stacking differentiate beta alumina from beta sub 1 alumina proper. The three structure types which share local responses to the interruption of the spinel sequence and the replacement of Me(2+) by Me(3+), but differ characteristically in their stabilization mechanisms, are considered as derivatives of spinel and discussed. Dissert. Abstr.

N80-12925 Ohio Univ., Athens.
LOW-TEMPERATURE SPECIFIC HEAT MEASUREMENTS OF SUPERCONDUCTING INDIUM-THALLIUM ALLOYS Ph.D. Thesis
Lakshmi Venkata Munukutla 1979 141 p
Avail: Univ. Microfilms Order No. 7924427

The superconducting transition temperature and the low temperature specific heats of In-Tl alloys are discussed. The specific heat measurements are performed in the temperature range from 4.8 - 1.0 K. The methods used to prepare and anneal these alloys are described. An ac susceptibility method was used to measure the transition temperature of these samples. A heat pulse technique was used to measure the specific heats both in zero field and in the presence of 408 Oe magnetic field. Both the ac susceptibility method and the heat pulse technique are described in detail. A section is devoted to thermometry. The designs of the ac susceptibility probe and the specific heat probe are described. The superconducting transition temperatures obtained for these In-Tl alloys are compared with previous measurements. Dissert. Abstr.

N80-12926 Iowa Univ., Iowa City.
X-RAY DIFFRACTION STUDY OF THE ALLOY SYSTEM SmP(x)S(1-x) Ph.D. Thesis

Kevin James Sisson 1979 190 p
Avail: Univ. Microfilms Order No. 7924531

The alloy system Sm P sub x S sub 1-x was examined through lattice parameter measurements as a function of temperature. Alloys were prepared by heating compressed powders of SmS and SmP. The temperature dependence of the lattice parameter in the range from 400 K to 70 K was determined from Debye-Scherrer X-ray powder diffraction films, for samples prepared in the concentration range of 3 to 20 mole percent phosphorus. The temperature dependence of the lattice parameters of SmS and SmP was also determined in this temperature range. Guinier-de Wolff camera films at 300 K of these samples were made, and the diffraction patterns analyzed with an integrating densitometer. The temperature dependence of the magnetic susceptibility of these samples was measured and the values are discussed. Dissert. Abstr.

N80-12927 Iowa State Univ. of Science and Technology, Ames.
MAGNETIC AND ELECTRONIC PROPERTIES OF Nd-La AND Ce-La ALLOYS Ph.D. Thesis
Thomas Sonke Petersen 1979 101 p
Avail: Univ. Microfilms Order No. 7924264

The magnetic ordering temperatures of polycrystalline double-hexagonal close packed (dhcp) Ce-La and Nd-La alloys and Nd single crystals were determined by measuring the electrical resistivity, thermoelectric power and magnetic susceptibility. The heat capacity of Nd was shown to have several peaks between 5K and 8K. The resistivity and thermopower show some of these same anomalies. Some of these anomalies are dependent on the thermal history of the sample. The Ce-La alloys were pure dhcp only for large Ce or large La concentrations. Intermediate concentration alloys contained the fcc phase. These alloys show two magnetic ordering temperatures for the dhcp phase and an additional one for the fcc phase. Kondo effects are seen in both the thermoelectric power and resistivity of alloys containing Ce. The effects are explained by crystal field or mean field Kondo theories. Dissert. Abstr.

N80-12928 California Univ., Los Angeles.
INTERVALLEY TRANSFER IN N-TYPE GERMANIUM AT 77 DEG K Ph.D. Thesis
Walter Harry Pate 1979 426 p
Avail: Univ. Microfilms Order No. 7921445

The current density versus electric field characteristics of n-type germanium for resistivities ranging from 0.3 ohms-cm to 30 ohms-cm were measured at a lattice temperature temperature of 77 K for the electric field applied in the < 100 >, < 110 >, and < 111 > crystallographic directions. Data are also shown for 2 ohm-cm and 0.4 ohm-cm samples which are compensated with indium. From this data the conductivity anisotropy was observed and analyzed in terms of the repopulation of carriers between the different valleys. The experimental repopulation is given as a function of electric field and sample resistivity. Dissert. Abstr.

N80-12929 Brandeis Univ., Waltham, Mass.
AN NMR STUDY OF THE CRITICAL PHENOMENA OF MnF2 IN A 75 KG FIELD Ph.D. Thesis
Herbert Samuel Patz 1979 214 p
Avail: Univ. Microfilms Order No. 7925721

The technique of nuclear magnetic resonance (NMR) was used to study the critical behavior of manganous fluoride, MnF2, in an externally applied field of H sub 0 = 74.976 plus or minus 0.003 kG along the preferred axis. The NMR lineshapes of the two fluorine sites (alpha and beta) were measured as a function of temperature T for T approaching the critical temperature T sub c (H) from below. The static results with a preliminary analysis of the linewidth data are discussed. Dissert. Abstr.

N80-12930 Iowa State Univ. of Science and Technology, Ames.
LATTICE DYNAMICS OF hcp AND bcc ZIRCONIUM Ph.D. Thesis
Jerel L. Zarestky 1979 208 p
Avail: Univ. Microfilms Order No. 7924276

The lattice dynamics of hcp and bcc zirconium are examined using inelastic neutron scattering techniques. The temperature dependence of the normal vibrational modes of hcp Zr was studied by measuring the phonon dispersion curves in the /001/, /100/, and /110/ symmetry directions at 295 K, 793 K and 1007 K and in the /001/ direction and selected other points at 5.5 K. The phonon dispersion curves for bcc Zr were measured at 1423 K. The data for hcp and bcc Zr were used to calculate the lattice specific heat as a function of temperature. The total specific heat obtained by taking the electronic contribution into account, was found to be consistent to within experimental uncertainties, with the results of specific heat measurements for both hcp and bcc Zr. Dissert. Abstr.

N80-12931# Electronics Research Lab., Adelaide (Australia).
THE MEASUREMENT OF TEMPERATURE INSTABILITIES AND THEIR EFFECT ON THE LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Aug. 1979 31 p refs
(ERL-0077-TR; AR-001-667) Avail: NTIS HC A03/MF A01

Epitaxial layers grown on gallium arsenide substrates using the steady state temperature gradient form of liquid phase epitaxy are discussed and compared to the growth rate calculated for diffusion limited conditions. The large variation in epilayer thickness over the surface of a single sample, and the nonreproducibility from sample to sample are investigated. Various measurements of the temperature and its local variation within the gallium melt solution are described. An attempt to relate the observed variations and instabilities to the epitaxial layers actually grown is presented. A.W.H.

N80-12932# Oregon Graduate Center, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Report, 15 May 1978 - 15 Aug. 1979
L. W. Swanson Nov. 1978 161 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A072541; AFAL-TR-78-174; IR-4) Avail: NTIS HC A08/MF A01 CSCL 14/2

The purpose of this program is the development and characterization of high brightness field emission and field ion sources. Several emitter materials and modes of operation for both field electron and ion sources have been investigated. The most promising sources have been examined with respect to fabrication techniques, source stability and life, spatial energy and distribution of the emitted beam. Optical characteristics of the source, e.g. virtual source size, etc., have also been examined. From this study two electron and one gas phase field ion emitters have met most of the source requirements to be of interest for high current density submicron focussed beam applications. In addition, the liquid gallium source has been investigated with respect to both electron and ion emission. The electron emission mode exhibits an unusual high peak current pulse mode while the ion emission mode results in an extremely intense d.c. mode. The ion emission mode is 100 to 1000 times more intense than the gas phase field ion sources. GRA

N80-12933# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Labs.
LIFETIME CONTROL IN SILICON THROUGH FOCUSED LASER BEAM DAMAGE Final Report, 1 May 1978 - 30 Apr. 1979
G. H. Schwuttke and K. H. Yang 30 Jun. 1979 93 p refs
(Contract N00173-76-C-0303; DARPA Order 3231)
(AD-A073052; TR-22.2290) Avail: NTIS HC A05/MF A01 CSCL 20/12

Minority carrier lifetime and resistivity engineering in silicon through use of high power laser beams is described. Unique doping profiles are produced through 80 Kev As(+) implantations followed by laser annealing. Minority carrier lifetime distributions on silicon surfaces are substantially improved through laser damage gettering. Laser operating conditions to obtain optimum lifetime and resistivity engineering effects are given. GRA

N80-12934# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary, 1 Nov. 1978 - 31 Jan. 1979
Alan L. McWhorter 15 Feb. 1979 82 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A073152; ESD-TR-79-8) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report covers in detail the solid state research work of

the Solid State Division at Lincoln Laboratory for the period 1 November 1978 through 31 January 1979. The topics covered are Solid State Device Research Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE. GRA

N80-12935# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND COMPARISON OF THE PHOTOELECTRIC PROPERTIES OF Sr2Nb2O7 AND Ba0.5Sr0.5Nb2O6
Aaron Wold, J. Hormadaly, S. N. Subbarao, R. Kershaw, and K. Dwight 20 Aug. 1979 24 p refs
(Contract N00014-77-C-0387)
(AD-A073192; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/12

The two alkaline earth niobates Sr2 Nb2 O7 and Ba0.5 Sr0.5 Nb O6 have been prepared, their electronic properties measured, and their photoresponses compared. The indirect band gap in Sr2 Nb2 O7 is 3.86 EV compared with 3.38 EV for Ba0.5 Sr0.5 Nb2 O6. Hence, photoanodes composed of Sr2 Nb2 O7 respond to much less of the white light spectrum than those made from Ba05 Sr0.5 Nb2 O6. Nevertheless, their electrical outputs at an anode potential of 0.8 EV with respect to SCE in 0.2 M sodium acetate under white xenon arc irradiation of 1.25 W/sq cm are comparable. GRA

N80-12936# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
ACOUSTIC WAVES IN CUBIC CRYSTALS NETWORKS FOR SEMICONDUCTING VIBRATORS, AND APPLICATIONS TO GALLIUM ARSENIDE
Arthur Ballato and Charles D. Bosco Apr. 1979 50 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A072764; DELET-TR-79-9) Avail: NTIS HC A04/MF A01 CSCL 20/2

Some consequences of acoustic bulk wave propagation in piezoelectric semiconductors of class 4-bar 3m are investigated. Doubly rotated plate vibrators are considered, as are coupled modes and transmission line equivalent networks. It is shown how sensitive measurements of oxide films may be simply made in a nondestructive manner by use of such crystals as piezoelectric vibrators. Calculations are carried out using gallium arsenide as a typical compound. GRA

N80-12937# Kanner (Leo) Associates, Redwood City, Calif.
THEORY OF INTERSTITIAL ORDERING IN ALLOYS WITH HEXAGONAL CLOSE-PACKED CRYSTAL LATTICE
V. N. Bugaev (Inst. of Metal Phys., Acad. of Sciences, USSR (Kiev)) Nov. 1978 14 p refs Transl. into ENGLISH from Ukr. Fiz. Zh., USSR, v. 23, no. 7, 1978 p 1073-1080
(IS-Trans-106; VAAP-00-2) Avail: NTIS HC A02/MF A01

A theory on the ordering of interstitial atoms in alloys with HCP crystal lattice is constructed. The theory which accounts for interatomic interaction in an arbitrary number of coordination spheres is evaluated. The discussion is conducted within the framework of the method of statistical concentration waves. The distribution of interstitial atoms about the interstices of pure metals (at the lattice sites) is discussed. DOE

N80-12938# Argonne National Lab., Ill.
ENERGY LEVEL STRUCTURE AND TRANSITION PROBABILITIES IN THE SPECTRA OF THE TRIVALENT LANTHANIDES IN LaF3
W. T. Carnall, H. Crosswhite, and H. M. Crosswhite 1978 199 p refs
(Contract W-31-109-eng-38)
(ANL-78-XX-95) Avail: NTIS HC A09/MF A01

Two types of correlations with experimental results are reported. For even-f-electron systems, a center of gravity was computed based on the energies of the observed states, and calculated optimized sets of atomic energy level parameters. For odd-electron systems complete crystal field calculations were performed in which parameters of both the atomic and crystal-field parts of the interaction were adjusted to experimental data. The result is a set of eigenvectors for all the ionic states in each configuration. Spectroscopic results for all lanthanides doped into LaF3(In(+3)(LaF3) except Pm3+ and Eu3+ are reported. DOE

N80-12939# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF ADDITIVES AND MOISTURE ON THE IONIC CONDUCTIVITY OF LiSMO4 (M = Al, Ga, Fe)
R. T. Johnson, Jr. and R. M. Biefeld 1979 11 p refs Presented at Fast Ion Transport in Solids-Electrode and Electrolytes Conf., Lake Geneva, Wisc., 21 May 1979
(Contract DE-AC04-76DP-00789)
(SAND-79-0541C; CONF-790538-3) Avail: NTIS HC A02/MF A01

When polycrystalline Li5MO4 (M = Al, Ga, Fe) is exposed to moisture, LiOH is formed within the material and produces a dramatic increase in the conductivity above approximately 400 C. The addition of Li2SO4 shifts this temperature to approximately 350 C due to a LiOH-Li2SO4 eutectic reaction. In the dry state, Li2SO4 additions increase the conductivity (10 to 100 times) to approximately 0.1 ohm/cm at 600 C. Annealing to 650 C in dry environments increases the conductivity activation energy from approximately 0.6 to approximately 1.0 eV, apparently due to the removal of LiOH from surface and grain boundary effects significantly influence the conductivity characteristics of these materials. DOE

N80-12940# Brookhaven National Lab., Upton, N. Y.
COLLECTIVE EFFECTS, RELAXATION AND LOCALIZATION OF HOLE LEVELS IN ATOMS, MOLECULES, SOLIDS, AND ADSORBATES
G. Wendin 1979 26 p refs Presented at Sanibel Symp. on Quantum Chem. and Solid State Phys., Palm Coast, Fla., 12 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-26058; CONF-790368-2) Avail: NTIS HC A03/MF A01

Recent progress in descriptions of photoelectron spectra is reviewed with emphasis on cases where the one-electron and quasiparticle approximations break down and the hole level becomes spread over a number of discrete lines or a continuum or both. Unifying aspects and similarities between interaction processes in atoms, molecules and solids are stressed. DOE

N80-12941# Argonne National Lab., Ill.
SUPERCELL CALCULATIONS OF POSITRON TRAPPING AND ANNIHILATION AT VACANCIES IN SIMPLE AND TRANSITION METALS
R. P. Gupta and R. W. Siegel 1979 6 p refs Presented at 5th Intern. Conf. on Positron Annihilation, Lake Yamanaka, Japan, 8 Apr. 1979
(Contract W-31-109-eng-38)
(CONF-790437-7) Avail: NTIS HC A02/MF A01

A new approach, based upon augmented-plane-wave calculations in a supercell lattice, was developed to theoretically predict the annihilation characteristics of the positron in vacancies, taking into account for the first time the atomic nature of the solid. This method, which is general and suited equally well to be simple and transition metals, was used to calculate positron trapping and annihilation characteristics in Al, Nb, Ta, and W. The results indicate that the positron is sufficiently strongly trapped in a vacancy in all of these metals that significant thermal detrapping in any of them is highly unlikely. DOE

N80-12942# California Univ., Livermore. Lawrence Livermore Lab.
PHOTOFISSION AND ELECTROFISSION
B. L. Berman 17 Aug. 1978 12 p refs Presented at the Intern. Conf. on Nucl. Interactions, Canberra, Australia, 28 Aug. - 1 Sep. 1978
(Contract W-7405-eng-48)
(UCRL-81596; CONF-780854-5) Avail: NTIS HC A02/MF A01

Recent experimental progress in the fields of photofission and electrofission of actinide nuclei is summarized. In particular, experimental results which throw light on the delineation of the characteristics of the giant resonances are highlighted. Measurements of especial interest in this regard include photofission cross section studies with monoenergetic photons and electrofission yield and angular distribution studies. DOE

N80-12943# Sandia Labs., Albuquerque, N. Mex.
HIGH PRESSURE STUDIES OF IONIC CONDUCTIVITY IN SOLIDS
G. A. Samara 1979 13 p refs Presented at the 7th Intern. AIRAPT Conf., Le Creusot, France, 30 Jul. 1979
(Contract EY-76-C-04-078)
(SAND-79-1511C; CONF-790709-6) Avail: NTIS HC A02/MF A01

The pressure dependence of the ionic conductivity in crystal lattices is studied. Information about the volume relaxation associated with the formation of lattice defects as well as with the diffusive motion of these defects is discussed. Pressure results on a variety of crystals are discussed with emphasis on recent results on crystals with large lattice polarizsbilities and soft phonon modes. DOE

N80-12212 Institut Franco-Allemand de Recherches, St. Louis (France).
ANALYSIS OF THE STRUCTURE DEFORMATION OF SODIUM CHLORIDE SUBMITTED BY A SHOCK WAVE
F. Jamet and F. Bauer *In its* Contrib. to Ballistics, Detonations, and Pulse Phys. 1979 p 209-226 refs In FRENCH; ENGLISH summary (For primary document see N80-12205 03-31)
Copyright. Avail: Issuing Activity

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-12944 Saint Louis Univ., Mo.
VARIATIONAL PADE APPROXIMANTS APPLIED TO THE THREE-AND FOUR-BODY PROBLEM Ph.D. Thesis
Ernest Raymond Bernardi 1979 40 p
Avail: Univ. Microfilms Order No. 7923809

The three and four body problems in quantum mechanics are considered. The particles are assumed to interact with each other through square well potentials. A determination of the lowest energy eigenvalue of each system is desired. Taking for each particle the well depth to be -7.9529 Mev. and range of 1.5 Fermi, we obtain a ground state energy of -17.5 Mev. for the four body system. The mathematical method used to solve the above problems is based on the Schwinger variational principle which in the end expresses the unknown energy eigenvalue as the ratio of polynomials of arbitrary degree (fixed beforehand) in the coupling constant, i.e., the Pade approximation. The equality of the eigenvalue to the ratio is true only when the Schwinger functional, which depends on a variational parameter, achieves a minimum. The Schwinger functional itself becomes the ground state energy when this minimum occurs. Dissert. Abstr.

N80-12945 Michigan Univ., Ann Arbor.
PERTURBATIVE APPLICATIONS OF QUANTUM CHROMODYNAMICS Ph.D. Thesis
Bruce Gregory Weeks 1979 88 p
Avail: Univ. Microfilms Order No. 7925244

Theoretical tools for obtaining experimental predictions from quantum chromodynamics perturbation theory are reviewed. These include the renormalization group, the Sterman-Weinberg approach, the parton model, the operator product expansion, leading logarithm summations, and the factorization schemes of Georgi, Politzer, et al., of Mueller, and of Sterman and Libby. Several applications are described, including total and two jet cross sections in e(+)e(-) annihilation, jet production from a gluon source, and deep inelastic lepton hadron scattering. The extent to which past and future experiments test quantum chromodynamics is considered. Dissert. Abstr.

N80-12946 Saint Louis Univ., Mo.
A THERMODYNAMIC THEORY OF STEADY-STATE SYSTEMS Ph.D. Thesis
Susan Joan Haney 1979 131 p
Avail: Univ. Microfilms Order No. 7923825

A rigorous, thermodynamic theory of steady state systems is developed by generalizing the methods used by Clausius and Kelvin in the development of classical thermodynamics (thermostatics). The principles of thermodynamics, which are extremely general, and the laws of thermostatics which are valid only for equilibrium systems are discussed. A new class of process, retraceable processes, and a new class of conversions of heat to work, recoverable conversions are defined. These are generalizations of reversible processes and reversible conversions, respectively. A set of necessary conditions for net conversion in steady state systems are determined. The principles of thermodynamics are applied to processes connecting steady states, and to conversions occurring in steady state systems. The existence of functions of state for steady state systems is thus shown. These functons of state are of two types, scalar functions and vector functions. Dissert. Abstr.

N80-12947# California Univ., Berkeley. Lawrence Berkeley Lab.
SEMICLASSICAL STATISTICAL MECHANICS Ph.D. Thesis
R. M. Stratt Apr. 1979 174 p refs
(Contract W-7405-eng-48)
(LBL-9095) Avail: NTIS HC A08/MF A01

A formalism is developed which allows the nonperturbative incorporation of of quantum effects into equilibrium classical statistical mechanics. The resulting expressions bear a close similarity to classical phase space integrals. Problems considered include the simple harmonic oscillator, the vibrational state distribution of HCl, the density-independent radial distribution function of He-4, and the statistical mechanics of nonanalytic potentials and of fluids. Some ramifications of having a phase space version of quantum mechanics are discussed. To test the breadth of the formulation, the task of constructing quantal ensemble averages of phase space functions is undertaken, and in the process several limitations of the formalism are revealed. The concept of quantum mechanical ergodicity is examined through the use of numerically evaluated eigenstates of the Barbanis potenial, and the existence of this quantal ergodicity normally associated with classical phase space - is verified. DOE

N80-12948# California Univ., Berkeley. Lawrence Berkeley Lab.
COMMENTS ON THE DERIVATION OF THE CARNOT EFFICIENCY ACCORDING TO MAX PLANCK: THERMODYNAMICS (ELEVENTH EDITION) DE GRUYTER 1964 AND R. CLAUDIUS: MECHANICAL HEAT THEORY (THIRD EDITION) VIEWEG 1887
Joachim Kirchhoff May 1979 24 p Transl. into ENGLISH from West German paper, 1979 23 p Sponsored by DOE
(UCRL-Trans-1572) Avail: NTIS HC A02/MF A01

A discussion on the derivation of the Carnot efficiency according to Max Planck is presented. The laws of thermodynamics are derived and examined in relation to the mechanical heat theory and Carnot's cycle. Planck's error in calculating the temperatures of the heat containers and not the temperatures of the working medium is examined. A.W.H.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-12949# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

RELIABILITY AND MAINTAINABILITY ANALYSIS: A CONCEPTUAL DESIGN MODEL
Anthony F. Czajkowski Mar. 1972 237 p refs
(AD-A073120; AFIT-SLTR-3-72) Avail: NTIS HC A11/MF A01 CSCL 05/1

This study combines aspects of utility theory, probability theory, and mathematical programming to develop an efficient method for performing reliability/maintainability analysis during the early conceptual stages of system development. The general concepts of operational capability and system life cycle cost are used to construct an operational model for determining subsystem reliability and maintainability 'design point' characteristics. Consideration of both technological and cost uncertainty is incorporated within the model. Specifically, the method developed provides a systematic and operationally efficient technique for selecting subsystem reliability/maintainability alternatives when (1) attainable subsystem reliability/maintainability levels are not known with certainty, (2) all life cycle element cost flows are not known with certainty, (3) chance-constraint restrictions exist on some or all of the following factors: system availability, weight, reliability, maintainability, and/or R and D cost, (4) some subsystem reliability/maintainability design alternatives are interdependent (contingent and/or mutually-exclusive), (5) the suitability of selecting any particular system (combination of subsystem reliability/maintainability alternatives) depends upon both cost and risk considerations. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-12950# General Research Corp., McLean, Va.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE STRUCTURE AND COMPOSITION SYSTEM (SACS) Final Report
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Aug. 1979 61 p refs
(Contract MDA903-78-C-0445)
(AD-A072947; GRC-1070-05-79-CR) Avail: NTIS HC A04/MF A01 CSCL 05/2

Previous reports have identified all current and developing procedures that are either directly or indirectly involved in the SACS process. Those reports also pointed out how these systems/procedures did or did not support the on-line SACS. This report now delineates what modifications must be made to the current and developing systems/procedures, and identifies new requirements that must be fulfilled to make the on-line SACS effective, efficient, and responsive to the Army's needs. GRA

N80-12951# Behavioral Technology Consultants, Silver Spring, Md.
IMPLICATIONS OF AN ALL-DIGITAL NAVY TECHNICAL INFORMATION PRESENTATION SYSTEM Final Report, May 1978 - May 1979
Thomas W. Frazer, J. Thomas Roth, Willard Y. Howell, and Shun Y. Huang 3 Jul. 1979 102 p
(Contract N00019-78-C-0175; ZF55522003)
(AD-A073095) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes an assessment of the application, implications, and developments involved in the introduction of a single-medium computer-administered Technical Information presentation system into the U. S. Navy. It defines the nature and operation of a hypothetical system of this type through development of a system scenario. It identifies and considers implications of introducing such a system into the Navy from various viewpoints, including economic, strategic, naval missions, energy and personnel considerations. It also defines developments and procedural modifications necessary for introduction of such a system by the mid- to late 1980's. Such a system of optimized Technical Information preparation, distribution, delivery, change and updating is viewed as fundamental to the process of reversing current trends toward decreased combat readiness. An all-digital data approach can permit improved solutions to problems of lowered personnel productivity and of inherent human limitations in understanding and maintaining ever more complex systems, as well as an improved technology for Technical Information centralization and control. GRA

N80-12952# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
MECHANICAL INTELLIGENCE: RESEARCH AND APPLICATIONS Final Report, 1 Oct. 1977 - 30 Sep. 1978
Robert C. Moore Aug. 1979 104 p refs
(Contract N00039-78-C-0080; ARPA Order 3175)
(AD-A073127) Avail: NTIS HC A06/MF A01 CSCL 09/2

Section I of this report gives some background information on the LADDER system, outlines the changes made to the architecture of the system, and briefly explains the enhanced capabilities produced by those changes. Section II discusses user experiences with the first-generation LADDER system and the response of SRI to the reports of those experiences. Section III describes new user features that have been added to LADDER. Section IV discusses SODA, an improved data access system for LADDER, explaining its new capabilities and the problems of supporting those capabilities in accessing distributed data. Section V describes how the system has been extended to access a heterogeneous data base consisting of both Datacomputer and DBMS-20 data base management systems. Section VI reports on progress to date in bringing the results of our longer-term research into the LADDER system, in the form of a new natural-language processor that will permit a greater range of natural-language questions and lay the groundwork for transporting the system to new data bases and new domains. Section VII lists the publications and presentations by the project staff during the period covered by this report. Finally, Appendix A gives more detail on the new formal query language for data access, and Appendix B describes an experimental French-language version of LADDER. GRA

N80-12953# General Accounting Office, Washington, D. C.
BETTER INFORMATION MANAGEMENT POLICIES NEEDED: A STUDY OF SCIENTIFIC AND TECHNICAL BIBLIOGRAPHIC SERVICES
6 Aug. 1979 75 p refs
(PB-298776/6; PSAD-79-62) Avail: NTIS HC A04/MF A01 CSCL 05B

GAO's study of government information centers providing bibliographic services to the scientific and technical community is presented. It confirmed the need for better management. Evidence of duplication, proliferation of facilities, and inconsistent cost recovery practices were found. The vagueness of authorizing laws and function statements contributes to the duplication of services. Each department and agency should designate a top official to coordinate and manage its information, and the Office of Management and Budget should establish a committee to coordinate government scientific and technical information activities. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-12954# Civil Aeronautics Board, Washington, D.C.
FEDERAL AVIATION ACT OF 1958
[1979] 197 p Revised
Avail: SOD HC

The general provisions of the Act are defined as well as the powers of the Civil Aeronautics board and procedures for their exercise. Public Law 95-504 (October 24, 1978) is included in this 1979 revision. A.R.H.

N80-12955# California Univ., Livermore. Lawrence Livermore Lab.
NATIONAL ENERGY ACT OF 1978: FAR WESTERN PERSPECTIVE. A STUDY FOR THE US DEPARTMENT OF ENERGY, FEDERAL REGION 9
D. Dorn and P. Moulthroup 15 Dec. 1978 77 p
(Contract W-7405-eng-48)
(UCID-17944-Rev-1) Avail: NTIS HC A05/MF A01

Information on the impact of the National Energy Act of 1978 (NEA) on Federal Region 9 was studied. The U.S. energy problem; the National Energy Act of 1978; the expected effects of the NEA on Federal Region 9 as a whole; and the expected impact of the NEA in Arizona, California, Hawaii, and Nevada are discussed. DOE

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.*

N80-12956# Committee on Rules and Administration (U. S. Senate).
POLICY COORDINATION GROUP FOR TECHNOLOGY DEVELOPMENT Annual Report
Washington GPO 1978 34 p refs Rept. for Comm. on Rules and Administration and the Comm. on House Administration, 95th Congr., 2d Sess., 1 Aug. 1978
(GPO-31-469; AR-1) Avail: US Capitol, Senate Document Room

The Congressional report of the policy coordination group for technology development is presented. Topics include the legislative information and status system, audio and video technology, microform technology, and computer hardware and software requirements. A.W.H.

N80-12957*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
BALTIMORE APPLICATIONS PROJECT Annual Progress Report, Jun. 1978 - May 1979
Thomas S. Golden and Philip Yaffee Jun. 1979 16 p refs
(NASA-TM-80577; APR-5) Avail: NTIS HC A02/MF A01 CSCL 05A

An update is presented for the following projects: (1) asphalt pavement recycling; (2) data collection platform/water quality monitoring; (3) digital emergency traffic routing; (4) fire department communications and dispatch system; (5) health department management information system; (6) hazardous materials; (7) coal gasification; and (8) emergency vehicle proximity sensing. A.R.H.

N80-12958*# Battelle Columbus Labs., Ohio.
TRAFFIC MODEL FOR COMMERCIAL PAYLOADS IN THE MATERIALS EXPERIMENT ASSEMBLY (MEA) Final Report
F. A. Tietzel [1979] 51 p
(Contract NASw-2800)
(NASA-CR-162454; BCL-OA-TFR-79-1) Avail: NTIS HC A04/MF A01 CSCL 05A

One hundred individuals representing universities, technical institutes, government agencies, and industrial facilities were surveyed to determine potential commercial use of a self-contained, automated assembly for the space processing of materials during frequent shuttle flights for the 1981 to 1987 period. The approach used and the results of the study are summarized. A time time-phased projection (traffic model) of commercial usage of the materials experiment assembly is provided. A.R.H.

N80-12959# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF A DEVELOPMENTAL HEAVY METALS WASTE TREATMENT SYSTEM Technical Report, May 1978 - May 1979
J. B. Lantz May 1979 83 p refs
(Contract DAMD17-78-C-6063)
(AD-A073131; LSI-ER-314-40-6) Avail: NTIS HC A05/MF A01 CSCL 13/2

The Heavy Metals Waste Treatment System, consisting of a precipitation reactor, a precision control and monitor system and an experimental parallel plate clarifier, has been used to evaluate hydroxide and sulfide precipitation processes for removal of heavy metals from industrial wastes containing 0 and 50% seawater. Removal of metals from simulated mixed-metal wastes by hydroxide precipitation was shown to be superior to theoretical projections apparently due to co-precipitation of minor components. However, the studies showed that discharge criteria cannot be met by this process alone for all metals of interest in industrial wastes, particularly if seawater is present. Also, optimum pH's vary for the different metals, and co-precipitation will not be quantitatively reliable. Hydroxide precipitation tests also showed that process demand for hydroxide reagent is roughly comparable to projections in the case of 0% seawater. However, treatment of 50% seawater can require as much as an order of magnitude higher reagent demand at high pH. The hydroxide process will therefore be uneconomical for testing or pretreating wastewaters containing high proportions of seawater, except at low pH's (e.g., 8 to 9). GRA

N80-12960# Cambridge Systematics, Inc., Mass.
DEMAND FOR SPECIAL PERFORMANCE VEHICLES, 1975 - 2025
Sep. 1978 107 p refs
(Contract W-7405-eng-48)
(UCRL-13911) Avail: NTIS HC A06/MF A01

Concepts were developed for alternative energy storage and propulsion systems for passenger cars and light trucks. These conceptual designs include battery electric systems, hydrogen powered systems, and the quasi-electric-drive hybrid with a small internal combustion engine (ICE) for range extension. The difference between the cost and performance of the special performance vehicles (SPVs) and ICEs was determined. The vehicle miles travelled by each SPV type were forecasted for 1975, 1985, 2000, and 2025. Market forecasts of SPVs in light truck applications and regional ton mile forecasts for heavy truck use were made for use in energy consumption and flow models. National aggregate forecasts of population, auto ownership, per capita income, vehicle miles travelled, ton miles, and other variables were also made. DOE

N80-12961# Westinghouse Research and Development Center, Pittsburgh, Pa.
PROGRAMMABLE ASSEMBLY RESEARCH TECHNOLOGY TRANSFER TO INDUSTRY, PHASE 2 Quarterly Report
R. G. Abraham, R. J. S. Stewart, T. Csakvary, L. Y. Shum, C. Ho, W. L. Rogers, and A. Meyerhoff 31 Mar. 1979 101 p refs
(Grant NSF ISP-78-18773)
(PB-299024/0; NSF/RA-790070; QR-1) Avail: NTIS HC A06/MF A01 CSCL 13H

The adaptable-programmable assembly system (APAS) pilot line conceptual design was modified because of longer cycle times of commercially available robots and the identification of more assembly operations and motor part variations. An in-line, power-and-free, buffered transfer system concept is used now for both end bell and final assembly. Computer and control system

requirements were determined for the supervisory, vision, path control, and sequence control subsystems. High risk portions of the APAS pilot system are identified and experiments planned. Vision system experimentation demonstrates what image processing execution time is well within the 1.5 second time goal needed to achieve the overall 15 second motor assembly cycle time. GRA

N80-12962# Mitre Corp., McLean, Va.
THE STATUS OF ADVANCED PROPULSION SYSTEMS FOR URBAN RAIL VEHICLES Final Report, Oct. 1978 - May 1979
Vilas D. Nene May 1979 227 p refs
(Contract DOT-UT-9002)
(PB-297980/5; MTR-79W0022; UMTA-VA-06-0053-79-1) Avail: NTIS HC A11/MF A01 CSCL 13F

With the advent of power electronics, more efficient alternate propulsion systems have been developed. These include chopper controls, ac drive with induction motors, systems using onboard energy storage, and ac drive with tabular axle motors. A technology review of advanced traction systems is presented, based on information and data gathered from propulsion equipment suppliers in Europe, Japan, and the United States. The status performance characteristics, significant advantages and disadvantages and the deployment of the hardware in revenue service for all these systems are discussed. GRA

N80-12963# Wisconsin Univ. - Madison. Dept. of Civil and Environmental Engineering.
BACKGROUND STUDY ON THE DEVELOPMENT OF A STANDARD LEACHING TEST Final Report
Robert Ham, Marc A. Anderson, Rainer Stegmann, and Robert Stanforth May 1979 275 p refs
(Grant EPA-R-804773)
(PB-298280/9; EPA-600/2-79-109) Avail: NTIS HC A12/MF A01 CSCL 13B

The recommended procedure is a batch or flask test, using distilled water plus other leaching media according to the characteristics of the landfill(s) of concern. One leaching medium simulates the leaching characteristics of leachate derived from actively decomposing municipal refuse landfills, for example. Test procedures were designed to provide information regarding the materials likely to be leached from a waste, an estimate of the maximum concentrations of these materials, an estimate of the amount of material likely to be released per unit weight of waste, and an indication of the effect of codisposal of the waste in question with mixed municipal refuse or other specific wastes. GRA

N80-12964# Department of Transportation, Washington, D. C.
TRANSPORTATION AND THE FUTURE Final Report
Norman G. Paulhus, Jr. Jan. 1979 71 p refs
(PB-298907/7; DOT-1-71-1) Avail: NTIS HC A04/MF A01 CSCL 13B

Technological developments in connection with urban, rural, intercity, cargo and space transportation over the next twenty to thirty years are covered. GRA

N80-12965# Texas Historical Commission, Austin.
HOUSTON CONFERENCE ON THE REVITALIZATION OF THE INNER CITY
Aug. 1979 25 p Conf. at Houston 5-6 May 1978
(Grant EDA-08-6-27556)
(PB-298906/9; EDA-79-0135) Avail: NTIS HC A02/MF A01 CSCL 13B

A conference on the Revitalization of the Inner City fulfilled an important task, and satisfied the major goals of its sponsors. It provided a forum for discussing redevelopment of Houston's inner city. The Foundation and the Commission involvement with revitalization proposed the conference to help educate those involved with revitalization by providing concrete examples of successful projects in Houston and other cities, and consequently, serve as a catalyst for solving the city's problems. The revitalization process required a cooperative effort between government, private enterprise and Houston citizens. GRA

N80-12966# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
LEVEL-OF-SERVICE CONCEPTS IN URBAN PUBLIC TRANSPORTATION
William Taylor and John Brogan Sep. 1978 22 p refs Sponsored by the Michigan State Highway Commission.
(PB-298849/1; UMICH-HSRI-78-50) Avail: NTIS HC A02/MF A01 CSCL 13B

The level of service concept as it might be applied to public transportation services is examined. Proposed definitions of public transportation level of service based on both system and rider attributes are described. The variation in public transportation quality as viewed by various user market segments is examined, and the sensitivity or demand elasticity to the various factors constituting level of service is then made. A proposed study methodology to evaluate the increased level of service provided to user groups in line with their perceived measures of service quality is outlined. GRA

N80-12967# Sperry Rand Corp., Great Neck, N. Y. Sperry Systems Management Div.
A COMMUNICATIONS TRADE-OFF STUDY FOR COMPUTERIZED TRAFFIC CONTROL VOLUME 2: APPENDIXES Final Report
J. Scott, R. Gordon, B. Soicher, J. Dudek, and R. Kroeger 22 Nov. 1978 195 p refs
(Contract DOT-FH-11-9275)
(PB-298844/2; GF-3704-1060-Vol-2; FHWA/RD-78/86) Avail: NTIS HC A09/MF A01 CSCL 13B

Detailed information on various topics relevant to reducing costs of computerized traffic control. Topics discussed include the following: vehicle detector data communications; multiplexing and modulation; error detection and correction; reliability and availability; characteristics of existing computerized traffic control systems; user owned wire pair communication; leased line communications; coax cable communications; Air path optical communications; fiber optics communications; radio communication; power line communication techniques. GRA

N80-12968# National Field Research Center, Inc., Washington, D. C.
A WORKFORCE AND TRAINING PROFILE FOR SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY Final Report
Jack F. Seum, Darold E. Albright, Robert D. Oxberger, Gary S. Lance, and Linda Bardelmeier 1979 164 p refs
(Grant EPA-T900-591-03)
(PB-298612/3; EPA-600/8-79-024) Avail: NTIS HC A08/MF A01 CSCL 13B

The Resource Conservation and Recovery Act of 1976, is divided into the following topics: (1) A workforce profile and analysis section studying the workforce needs of public and private agencies involved in solid waste management and recovery; (2) a section analyzing what are considered by sources in the field to be the principal blockages to initial employment and career advancement in solid waste management; and (3) an analysis of the U.S. Environmental Protection Agency's responsibilities for workforce development and training activities. Information in the report was obtained primarily from personnel, onsite interviews with officials directly involved in solid waste management, including officials at Federal, State, and local levels; representatives from the private sector and from professional associations; and academic officials connected with postsecondary education programs in solid waste mangement. GRA

N80-12969# Remak-Rosenbloom, Santa Barbara, Calif.
IMPLEMENTING PACKAGES OF CONGESTION-REDUCING TECHNIQUES: STRATEGIES FOR DEALING WITH INSTITUTIONAL PROBLEMS OF COOPERATIVE PROGRAMS
Roberta Remak and Sandra Rosenbloom Jun. 1979 140 p refs Sponsored in part by Am. Assoc. of State Highway and Transportation Officials and Federal Highway Admin.
(PB-298831/9; TRB/NCHRP/REP-205; ISBN-0-309-02912-0; LC-79-66248) Avail: NTIS MF A01; HC available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. 20418 $7.60 CSCL 13B

The institutional barriers to cooperative programs for implementing complex packages of congestion-reducing (C-R) techniques are identified. Experiences of 18 U.S. cities in carrying

out simpler joint agency transportation projects were studied. Sources of institutional problems and possible solutions are noted. This information is extrapolated to suggest problems that local agencies might meet in attempting to implement the C-R packages and suggest strategies for overcoming them. Problems and strategies are discussed as they relate to: (1) individual techniques selected for the package; (2) needs to coordinate activities of independent agencies; and (3) organizations and the characteristics of the implementation site. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-12970*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TIME-OF-FLIGHT SYSTEM ON THE GODDARD MEDIUM ENERGY GAMMA-RAY TELESCOPE
R. W. Ross and J. R. Chesney Oct. 1979 7 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, Calif., 17-19 Oct. Submitted for publication
(NASA-TM-80579) Avail: NTIS HC A02/MF A01 CSCL 03A

A scintillation counter time of flight system, incorporated into the Goddard 50 cm by 50 cm spark chamber gamma ray telescope is described. The system, which utilizes constant fractions timing and particle position compensation and digitizes up to 10 ns time differences to six bit accuracy in less than 500 ns is analyzed. The performance of this system during balloon flight is discussed. A.W.H.

N80-12971# Los Alamos Scientific Lab., N. Mex.
THEORETICAL LIGHT AND VELOCITY CURVES FOR CEPHEID VARIABLES
T. F. Adams, C. G. Davis, and C. F. Keller Dec. 1978 14 p refs
(Contract W-7405-eng-36)
(LA-7598-MS) Avail: NTIS HC A02/MF A01

A series of nonlinear Cepheid models were calculated with the DYN code. The models were used to extend to light curves the conclusion, based on velocity curves, that the observations of Cepheids cannot be matched unless the mass is significantly reduced (assuming a homogeneous composition). It is concluded that observed light curves are considerably more complex than previously thought. The light and velocity curves that were calculated should be useful guides for interpreting the observations. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-12972 Michigan Univ., Ann Arbor.
THE HE I TRIPLET LINE EMISSION IN CLASS 1 SEYFERT GALAXIES Ph.D. Thesis
Fred Ross Feldman 1979 97 p
Avail: Univ. Microfilms Order No. 7925147

The equations of statistical equilibrium are solved for an 11 level helium atom, including radiative and collisional transitions and allowing for self absorption from any level. Calculated triplet line intensities as a function of tau(lambda 10830) are presented in graphical form. The possible importance of photoionization from the n = 2 levels by continuum and resonance line radiation is investigated. New spectrophotometric observations of 3C 120, Mrk 618, NGC 7469, and Mrk 335 are compared to the theoretical results. Dissert. Abstr.

N80-12973 Pittsburgh Univ., Pa.
ON THE RELATIONSHIP BETWEEN LYMAN-ALPHA AND 21-CM RADIATION AS IT APPLIES TO CLOUDS OF GAS ASSOCIATED WITH QUASI-STELLAR OBJECTS Ph.D. Thesis
John J. Urbaniak 1979 131 p
Avail: Univ. Microfilms Order No. 7924771

A model is proposed in which Lyman-continuum radiation emitted by the QSO is converted to Lyman-alpha radiation in an ionized portion of the cloud. This Lyman-alpha radiation propagates through the neutral portion of the cloud, where it will lower the spin temperature provided that the intensity is high and it has the proper spectral characteristics. Parameters pertaining to the model are obtained from observations of the object 1331 + 170 and the equation of radiative transfer is solved numerically in both the ionized and neutral sections of the cloud. The results of these calculations verify that the Lyman-alpha mechanism lowers the spin temperature enough to permit 21-cm absorption in clouds located near (approximately 1 kpc) or intrinsic to quasi-stellar objects. The model predicts the appearance of a characteristic double-hump, that is, two emission peaks which should be located in the broad, deep Lyman-alpha absorption trough 1331 + 170. Dissert. Abstr.

N80-12974 Pittsburgh Univ., Pa.
VERTICAL STRUCTURE OF GALACTIC GASEOUS DISKS Ph.D. Thesis
Allan Douglas Tubbs 1979 124 p
Avail: Univ. Microfilms Order No. 7924686

A theoretical examination of the vertical structure of galactic gaseous disks is discussed in light of recent observational studies of external galaxies and of our own galaxy. Both the large scale and fine scale structure of these disks are considered. The unperturbed large scale distribution of the gas of our galaxy and its implications to the galactic mass distribution are examined. The warp observed in NGC 5907 is examined in detail and is found to be consistent with either a tidal or primordial origin. On a fine scale (approximately 100 pc) the two dimensional response of the gas to a spiral density wave is examined. The self gravity of the gas is considered and is shown to be important for average midplane gas densities of over .5 particles per/cucm. Dissert. Abstr.

N80-12975 Iowa Univ., Iowa City.
ON THE ACCELERATION OF ENERGETIC PROTONS BY INTERPLANETARY SHOCK WAVES Ph.D. Thesis
Mark Elliott Pesses 1979 230 p
Avail: Univ. Microfilms Order No. 7924515

The acceleration of energetic protons in interplanetary magnetosonic fast mode shock waves is studied via analytical modeling, numerical simulations and in situ observations. It is shown that it is physically impossible for charged particles to be Fermi accelerated by MHD shock waves or discontinuities. An analytical model is presented in which the particle shock interaction is viewed in an intermediate frame in which the upstream and downstream electric fields are simultaneously zero. The analytical predictions of post shock energies and pitch angles and shock reflection and transmission coefficients are discussed. Dissert. Abstr.

N80-12976 City Univ. of New York, N. Y.
COSMOLOGICAL TESTS OF A SCALE COVARIANT THEORY OF GRAVITATION Ph.D. Thesis
Jane Rix Owen 1979 300 p
Avail: Univ. Microfilms Order No. 7923757

The Friedmann models with Lamda = 0, subjected to several optical and radio tests within the standard and scale covariant theories of gravitation are examined. Both interferometric and scintillation data are interpreted in terms of selection effects and evolution. The full solution to Einstein's gravitational equations in atomic units for a matter dominated universe, the study of the magnitude vs. redshift relation for elliptical galaxies,

the isophotal angular diameter vs. redshift relation, the metric angular diameter vs. redshift relation, and the integrated and differential expressions for the number count vs. radio flux test are discussed. Dissert. Abstr.

N80-12977 Maryland Univ., College Park.
BLACK HOLES AND COSMIC CENSORSHIP Ph.D. Thesis
William Allen Hiscock 1979 243 p
Avail: Univ. Microfilms Order No. 7925744

The validity of the cosmic censorship hypothesis which states that singularities which are even locally naked are never produced in a black hole is investigated. The possibility of converting an extreme Kerr-Newman black hole into a naked singularity by the accretion of test particles is studied. The motion of test particles with a large angular momentum to energy ratio, and test particles with a large charge to energy ratio are examined. The possible black hole interior solutions are studied. The effects of the Hawking black hole evaporation process on black hole interiors are considered. Dissert. Abstr.

N80-12978 Michigan Univ., Ann Arbor.
ANALYTIC THEORY OF ORBIT CONTRACTION AND BALLISTIC ENTRY INTO PLANETARY ATMOSPHERES Ph.D. Thesis
James Michael Longuski 1979 140 p
Avail: Univ. Microfilms Order No. 7925185

Equations of motion are derived to provide a set of universal entry equations applicable to all regimes of atmospheric flight from orbital motion under the dissipative force of drag through the dynamic phase of reentry and finally to the point of contact with the planetary surface. A complete uniformly valid theory is developed for orbit contraction due to atmospheric drag for all elliptic orbits in the case of orbital motion. A simple model is chosen in which the atmospheric density is assumed to vary exponentially with altitude. The universal entry equations applied to the problem of ballistic entry are described. The analytic theory of ballistic entry is developed by analyzing the three typical cases: (1) entry from a decaying orbit, (2) entry with circular speed at small initial flight path angles and (3) entry at moderate and large initial flight path angles with arbitrary speed. The second order theory is developed by applying Poincare's method of small parameters to a system of nonlinear equations. Dissert. Abstr.

N80-12979*# Planetary Science Inst., Tucson, Ariz.
COLLISIONAL AND DYNAMICAL PROCESSES IN MOON AND PLANET FORMATION Semiannual Report, 23 May - 22 Nov. 1979
22 Nov. 1979 106 p refs
(Contract NASw-2909)
(NASA-CR-162500; SAI-1-141-00-633-03) Avail: NTIS HC A06/MF A01 CSCL 03B

The collisional and dynamical processes in moon and planet formation are discussed. A hydrodynamic code of collision calculations, the orbital element changes due to gravitational scattering, a validation of the mass shifting algorithm, a theory of rotations, and the origin of asteroids are studied. A numerical model of planet growth is discussed and a methodology to evaluate the rate at which megaregolith increases its depth as a function of total accumulate number of impacts on an initially smooth, coherent surface is described. A.W.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-12980* Texas Univ. at Austin.
ANALYSIS OF LUNAR SEISMIC SIGNALS: DETERMINATION OF INSTRUMENTAL PARAMETERS AND SEISMIC VELOCITY DISTRIBUTION Ph.D. Thesis
Peter Horvath 1979 354 p refs
(Grant NsG-7418)
(NASA-CR-162603) Avail: NTIS HC A16/MF A01 CSCL 03B

Inverse filters were designed to correct the effect of instrumental response, coupling of the seismometer to the ground, and near surface structures. The least squares technique was used to determine the instrumental constants and the transfer functions of the long period lunar seismographs. The influence of noise and the results of these calculations are discussed. R.C.T.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-12981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EMPIRICAL POLYTROPE LAW FOR SOLAR WIND THERMAL ELECTRONS BETWEEN 0.45 AND 4.76 AU: VOYAGER 2 AND MARINER 10
Edward C. Sittler, Jr. and J. D. Scudder Nov. 1979 26 p refs Submitted for publication
(NASA-TM-80594) Avail: NTIS HC A03/MF A01 CSCL 03B

Empirical evidence is presented that solar wind thermal electrons obey a polytrope law with polytrope index gamma = 1.175 plus or minus 0.03. The Voyager 2 and Mariner 10 data used as evidence are compared and discussed. The theoretical predictions that solar wind thermal electrons in the asymptotic solar wind should obey a polytrope law with polytrope index gamma = 1.16 plus or minus. The widespread impressions in the literature that solar wind electrons behave more like an isothermal than adiabatic gas, and the arguments that Coulomb collisions are the dominant stochastic process shaping observed electron distribution functions in the solar wind are reexamined, reviewed and evaluated. The assignment of the interplanetary potential as equal to approximately seven times the temperature of the thermal electrons is discussed. A.W.H.

N80-12982# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT OF CIRCUMSOLAR RADIATION: STATUS REPORT
D. F. Grether, A. Hunt, D. Evans, and M. Wahlig Sep. 1978 4 p refs Presented at the 3d Solar Heating and Cooling R and D Branch Contractors Meeting, Washington, D. C., 24 Sep. 1978
(Contract W-7405-eng-48)
(LBL-8391; CONF-780983-7) Avail: NTIS HC A02/MF A01

Four instruments systems, each of which contains a scanning telescope to make the circumsolar measurements, and includes standard solar and meteorological instruments, were deployed at sites of interest to various DOE programs utilizing concentrating collectors systems. The telescope remain more or less in the same place for a period on the order of a year, so that seasonal variations can be quantified. The data obtained are stored and processed, and the results made available to the various solar concentrating collector projects in a form appropriate to each project. These forms include: (1) sample scans of the telescope for a particular time or for a variety of conditions; (2) variation in solar and circumsolar radiation over the course of a day, month or year; and (3) detailed data suitable for input to computer-based simulations or solar energy conversion systems. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-12983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETECTION OF A FAST, INTENSE AND UNUSUAL GAMMA RAY TRANSIENT
T. L. Cline, U. D. Desai, G. Pizzichini, B. J. Teegarden, W. D. Evans (LASL, N. Mex.), R. W. Klebesadel (LASL, N. Mex.), J. G. Laros (LASL, N. Mex.), K. Hurley (Centre d'Etude Spatiale des Rayonnements), M. Niel (Centre d'Etude Spatiale des Rayonnements), G. Vedrenne (Centre d'Etude Spatiale des Rayonnements) et al Sep. 1979 17 p Submitted for publication
(NASA-TM-80570) Avail: NTIS HC A02/MF A01 CSCL 03B

An unusual transient pulse of approximately > 50 keV was detected by the gamma-ray burst sensor network using nine space probes and satellites. Its characteristics are unlike those of the known variety of gamma-ray bursts and therefore suggest that it was formed either by a completely different origin species or in a very different manner. It is identified with the LMC supernova remnant N49. Author

N80-12984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELEMENTAL COMPOSITION, ISOTOPES, ELECTRONS AND POSITRONS IN COSMIC RAYS
V. K. Balasubrahmanyan Sep. 1979 16 p refs Submitted for publication
(NASA-TM-80571) Avail: NTIS HC A02/MF A01 CSCL 03B

Papers presented at the 16th International Cosmic Ray Conference, Kyoto, Japan, dealing with the composition of cosmic rays are reviewed. Particular interest is given to data having bearing on nucleosynthesis sites, supernovae, gamma-process, comparison with solar system composition, multiplicity of sources, and the energy dependence of composition. A.R.H.

N80-12985*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF DIFFUSE GALACTIC GAMMA RAYS
George A. Simpson Oct. 1979 14 p refs Presented at 22d Plenary Meeting, COSPAR, Bangalore, India Submitted for publication
(NASA-TM-80578) Avail: NTIS HC A02/MF A01 CSCL 03B

The observations of galactic diffuse gamma radiation are reviewed. The connections of the gamma ray observations with galactic structure and cosmic rays are discussed. The high latitude galactic component and the low latitude emission from the galactic plane are examined. The observations in other regions of the gamma ray spectrum are discussed. A.W.H.

N80-12986*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROPULSATIONS IN THE ELECTRIC FIELD NEAR THE PLASMAPAUSE, OBSERVED BY ISEE-1
T. E. Moe, N. C. Maynard, and J. P. Heppner Oct. 1979 33 p refs Submitted for publication
(NASA-TM-80580) Avail: NTIS HC A03/MF A01 CSCL 03B

The occurrence of micropulsations near and inside the plasmapause was surveyed. The observed pulsations, classified as Pc3 and Pi2, are discussed. In addition one single event of Pc1 was observed. The frequencies in the Pc3 and Pi2 bands, the amplitude ranges, and the direction of rotation for the electric field vector are reported. A.W.H.

N80-12987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY LINE EMISSION FROM THE TYCHO SUPERNOVA REMNANT
Steven H. Pravdo, B. W. Smith, P. A. Charles (California Univ., Berkeley), and I. R. Tuohy (California Inst. of Technology) Oct. 1979 16 p refs Submitted for publication
(NASA-TM-80581) Avail: NTIS HC A02/MF A01 CSCL 03B

The observation of the X-ray spectrum of the Tycho supernova remnant in the energy range 0.5 to 20 keV is discussed. Four significant line features in the spectrum: The K alpha lines of silicon, sulphur, and iron; and the L lines of iron are examined. Comparisons between the silicon and sulphur equivalent widths and K alpha iron line energies of Tycho and Cas A are discussed. Suggest that the X-ray emitting plasma in Tycho is further from collisional ionization equilibrium than that of Cas A. A.W.H.

N80-12988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF HIGH ENERGY X-RAYS FROM THE GALACTIC CENTER REGION
B. R. Dennis, J. H. Beall, E. P. Cutler, C. J. Crannell, J. G. Dolan, K. J. Frost, and L. E. Orwig Oct. 1979 25 p refs Submitted for publication
(NASA-TM-80584) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations of the galactic center region made with the high energy X-ray detector on OSO-8 are discussed. A strong hard X-ray which was detected during these observations from the vicinity of the galactic center are examined. The counting rate spectrum and the photon number spectrum of the flux are determined. Comparisons with the high energy X-ray fluxes observed from sources in the region by others are discussed. A.W.H.

N80-12989*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPLICATIONS OF CYCLOTRON FEATURES IN THE X-RAY SPECTRUM OF HER X-1
R. Bussard May 1979 48 p refs Submitted for publication
(NASA-TM-80588) Avail: NTIS HC A03/MF A01 CSCL 03B

The X-ray spectra from binary pulsars is investigated through the modification of physical processes due to an intense magnetic field. An effective scattering cross section for line photons and the Coulomb cross section for electron-ion collisions, treating the electrons relativistically, are calculated. The quantization of electron orbits in strong fields are discussed. The absorption cross sections and emission rates for cyclotron photons are calculated. An application of the results to the data from Hercules X-1 is examined. A.W.H.

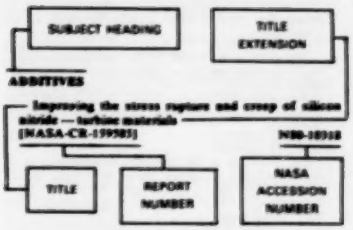
99 GENERAL

N80-12990# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD BULLETIN TECHNICAL PROGRAMME, 1980
Aug. 1979 33 p
(AGARD-Bull-79/2) Avail: NTIS HC A03/MF A01

A list of scheduled meetings for 1980 is presented along with descriptions of programs. Budget and publications summaries are included. F.O.S.

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

ABRASIVES
Abrasive machining of major components
[AD-A071916] N80-12415
ABSORPTANCE
Ultrasonic velocity and absorption measurements in several binary mixtures with pyridine
N80-12817
ABUNDANCE
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
ACCELERATED LIFE TESTS
Experimental verification of a combined environment accelerated aging method applied to electrical cable material
[SAND-78-1907A] N80-12424
ACCELERATION [PHYSICS]
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation — surface navigation
[AD-A073153] N80-12081
ACCELEROMETERS
Synthesis of flight results of the Cactus accelerometer for accelerations below one billionth G
N80-12033
Atmosphere explorer MESA accelerometer density data base
[AD-A072851] N80-12749
ACID BASE EQUILIBRIUM
Two-body positive ion-negative neutralization
[AD-A073145] N80-12646
ACID RAIN
Some potential effects of acid rain on forest ecosystems: Implications of a computer simulation
[BNL-50589] N80-12630
ACIDITY
An investigation of the acidity of stratus cloud water and its relationship to droplet distribution, pH of rain, and weather parameters
N80-12616
ACOUSTIC ATTENUATION
An experimental study of acoustic propagation and attenuation in a circular annular duct with a variable cross-sectional area
N80-12816
ACOUSTIC DUCTS
Reciprocity principle in duct acoustics
[NASA-TM-79300] N80-12824
ACOUSTIC EMISSION
Acoustic emission method for stress and strain determination
[AD-A072774] N80-12448
ACOUSTIC MEASUREMENTS
Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820
ACOUSTIC PROPAGATION
An experimental study of acoustic propagation and attenuation in a circular annular duct with a variable cross-sectional area
N80-12816
ACOUSTO-OPTICS
Guided wave acousto-optic devices for wideband real-time signal processing
N80-12253
ACTINIDE SERIES
Actinide cross section data and inertial confinement fusion for long term waste disposal
[UCRL-82177] N80-12859
ADAPTIVE CONTROL
An adaptive quantizer with channel error recovery
N80-12231
An adaptive delta modulator robust to transmission errors
N80-12234
ADDITIVES
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12366
ADHESIVES
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12385
ADSORPTION
Vacancy solution and two-dimensional gas models for gas mixture adsorption
N80-12340
AERIAL PHOTOGRAPHY
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
Block-adjustment programs for minicomputers
N80-12464
On measurements from aircraft — conference, Hanover, 29-31 August 1977
[BMFT-FB-W-78-04] N80-12467
Future remote sensing program of the DFVLR
N80-12470
From satellite images to aerial survey photographs: Comparison between observations of the Jade region made with different sensors
N80-12472
Colored substance mining experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Interpretation of water quality using remote sensing techniques
N80-12493
Aerial photography of agricultural farming land
N80-12496
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499
Development of processing methods for images of the Jade coast region and experience acquired
N80-12504
Geometrical restitution of multispectral scanning images
N80-12506
Application of DIBIAS programs for improvements and geoscientific evaluations of LANDSAT photographs of central Morocco and Sudan
N80-12510
AERIAL RECONNAISSANCE
Large scale thermal images as a means of distinguishing between building structures in a town
N80-12490
Texture analysis as a recognition parameter for different types of forests
N80-12498
Airborn measurements of optical atmospheric properties, summary and review 3
[AD-A073121] N80-12645
AEROACOUSTICS
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Aeroacoustic characterization of free jets
N80-12025
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
AERODYNAMIC CHARACTERISTICS
Aerodynamic characteristics of a hypersonic research airplane concept having a 70 deg swept double-delta wing at Mach numbers from 0.80 to 1.20, with summary of data from 0.20 to 4.0 — Langley 8-ft transonic wind tunnel
[NASA-TP-1552] N80-12064
Application of supersonic linear theory and hypersonic impact methods to three nonslender hypersonic airplane concepts at Mach numbers from 1.10 to 2.86
[NASA-TP-1539] N80-12065
AERODYNAMIC COEFFICIENTS
Prediction of drag coefficients of a supersonic V/STOL configuration with various store arrangements
[AD-A072999] N80-12085
AERODYNAMIC CONFIGURATIONS
Preliminary design aerodynamic prediction methodology for missiles with nose bluntness
[AD-A073664] N80-12111
AERODYNAMIC DRAG
Prediction of drag coefficients of a supersonic V/STOL configuration with various store arrangements
[AD-A072999] N80-12085
AERODYNAMIC FORCES
A survey of aeroelastic problems
N80-12001
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
Effect of horizontal and vertical side forces and moments on stability of a symmetric missile in ascending or descending flight
[AD-A072808] N80-12067
AERODYNAMIC LOADS
Aeroelasticity from the viewpoint of the designer
N80-12002
Trestle wind tunnel study
[AD-A072791] N80-12069
A shock tube investigation of silo-launched vehicle aerodynamic flow asymmetries
[AD-A071811] N80-12110
The effects of freestream turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239
AERODYNAMIC STABILITY
Determination in ground facilites of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12102
AERODYNAMICS
Aeronautical engineering. A continuing bibliography with indexes, supplement 114
[NASA-SP-7037[114]] N80-11999
A survey of aeroelastic problems
N80-12001
Modal analysis of aircraft structures
N80-12003
Unsteady aerodynamic inputs for aeroelastic analyses: A general introduction
N80-12008
Supersonic combustion, air dissociation through shock waves and aerodynamics of chemically reacting gases in a Planar converging - diverging nozzles — supersonic combustion ramjet engines
[AD-A073135] N80-12097
AEROELASTICITY
Aeroelastic Problems in Aircraft Design
[VKI-LEC-SER-1979-4] N80-12000
A survey of aeroelastic problems
N80-12001
Aeroelasticity from the viewpoint of the designer
N80-12002
Modal analysis of aircraft structures
N80-12003
Lifting surface divergence and control effectiveness
N80-12004
Unsteady aerodynamic inputs for aeroelastic analyses: A general introduction
N80-12008
Remarks on the transonic flow past oscillating airfoils
N80-12009
Aircraft flutter and dynamic response
N80-12010
Wind tunnel flutter investigations
N80-12011
Flight flutter testing
N80-12012

Development of stability methods for application to nonlinear aerodynamic optimization
N80-12052

Aeroelastic response analysis of two dimensional, single and two degree of freedom airfoils in low-frequency, small-disturbance unsteady transonic flow
[AD-A073379] N80-12073

AERONAUTICAL ENGINEERING
Aeronautical engineering. A continuing bibliography with indexes, supplement 114
[NASA-SP-7037(114)] N80-11999

AEROSOLS
Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/6] N80-12402

Airborne measurements of cloud-forming nuclei and aerosol particles in stabilized ground clouds produced by solid rocket booster firings
[NASA-CR-160357] N80-12663

Laboratory investigations of cloud forming nuclei and aerosol particles from unpressurized burns of space shuttle propellant
[NASA-CR-160358] N80-12664

AEROSPACE ENVIRONMENTS
Specification of the natural plasma environment at geosynchronous orbit
[AD-A073160] N80-12083

AFRICA
Climatic variability and land use: An African perspective
N80-12686

AGING (MATERIALS)
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials — PETN and HNS in explosive components
[SAND-79-0935C] N80-12150

The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177

Experimental verification of a combined environment accelerated aging method applied to electrical cable material
[SAND-78-1907A] N80-12424

AGRICULTURE
Applicability of multiscanning techniques to establishing inventories for agricultural farming and forestry
N80-12500

Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Gremdon Underwood and Newbury, England
[ESD-80022] N80-12525

Global aspects of food production
N80-12680

Climatic variability and agriculture in the temperate regions
N80-12681

Climatic variability and agriculture in tropical moist regions
N80-12682

Climatic variability and agriculture in the semi-arid tropics
N80-12683

Climatic change and the exploitation of climatic resources in China
N80-12684

Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685

Climatic variability and land use: An African perspective
N80-12686

AGROCLIMATOLOGY
Climate at the millennium
N80-12646

Global aspects of food production
N80-12680

AILERONS
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053

AIR CARGO
Technology options for an enhanced air cargo system
[NASA-TM-80173] N80-12076

AIR CONDITIONING
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629

AIR FLOW
Heat transfer in a column packed with spheres
N80-12343

AIR LAND INTERACTIONS
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-12407

Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12498

AIR POLLUTION
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029

Spectrometer for the first Spacelab payload
N80-12034

Gas sample storage
[PB-298350/0] N80-12152

Approaches to level 2 analysis based on level 1 results, MEG categories and compounds, and decision criteria — air pollution monitoring
[EPA-600/7-79-063A] N80-12153

Environmental assessment report: Lurgi coal gasification systems for SNG
[PB-298309/0] N80-12304

Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/6] N80-12402

Studies on the collection and analysis of nitrite and ammonium ions in atmospheric particulate matter
N80-12618

Estimates for wet and dry removals contribution to the residence time for atmospheric pollutants in the eastern United States
[SR-0980-6] N80-12626

Optimized chemiluminescence system for measuring atmospheric ammonia
[PB-298246/6] N80-12633

Emissions assessment of conventional stationary combustion systems. Volume 1: Gas- and oil-fired residential heating sources
[PB-298694/6] N80-12637

Predictions of the effects on the stratosphere of changes in the oxides of nitrogen
[UCRL-82553] N80-12651

AIR QUALITY
Air-to-air heat exchangers: Saving energy and improving indoor air quality
[LBL-9381] N80-12380

AIR SAMPLING
Studies on the collection and analysis of nitrite and ammonium ions in atmospheric particulate matter
N80-12618

Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629

AIR TRAFFIC CONTROL
DABS single sensor performance test plan
[AD-A072695] N80-12080

AIR TRANSPORTATION
Federal Aviation Act of 1958
N80-12954

AIR WATER INTERACTIONS
Laboratory modelling of oceanic response to monsoonal winds
[TR-15] N80-12459

The physical basis of climate
N80-12671

Modelling of climatic changes and the problem of long-range weather forecasting
N80-12672

Proceedings of the annual climate diagnostics workshop — covering ocean related climate characteristics
[PB-298355/9] N80-12717

AIRCRAFT BRAKES
Behavior of aircraft antiskid braking systems on dry and wet runway surfaces. A slip-velocity-controlled, pressure-bias-modulated system
[NASA-TP-1051] N80-12084

AIRCRAFT CONTROL
The impact of global positioning system on guidance and controls systems design of military aircraft, volume 1
[AGARD-AR-147-VOL-1] N80-12082

AIRCRAFT DESIGN
Aeroelastic Problems in Aircraft Design
[VKI-LEC-SER-1979-4] N80-12000

Aeroelasticity from the viewpoint of the designer
N80-12002

Aircraft flutter and dynamic response
N80-12010

The development of the DAST 1 remotely piloted research vehicle for flight testing an active flutter suppression control system
N80-12083

The performance of a conceptual vertical attitude takeoff and landing fighter aircraft
[AD-A073100] N80-12086

Inertia calculation procedure for preliminary design
[AD-A072679] N80-12087

AIRCRAFT ENGINES
Engine component improvement program: Performance improvement — fuel consumption
[NASA-TM-79304] N80-12092

AIRCRAFT GUIDANCE
The impact of global positioning system on guidance and controls systems design of military aircraft, volume 1
[AGARD-AR-147-VOL-1] N80-12082

AIRCRAFT MANEUVERS
AH-1G lateral flight performance test
[AD-A072866] N80-12088

AIRCRAFT MODELS
Trentic wind tunnel study
[AD-A072791] N80-12069

AIRCRAFT NOISE
Aviation Safety and Noise Abatement Act of 1979
[S-REPT-96-52] N80-12621

Aircraft noise and the market for residential housing: Empirical results for seven selected airports
[PB-297681/9] N80-12635

A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818

Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819

Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820

AIRCRAFT SAFETY
An evaluation of the bird/aircraft strike hazard at selected United Kingdom bases: RAF Mildenhall, RAF Alconbury, RAF Upper Heyford, RAF Bentwaters, RAF Fairford, RAF Lakenheath, and RAF Woodbridge
[AD-A073062] N80-12077

Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079

AIRCRAFT STABILITY
Determination in ground facilities of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12302

AIRCRAFT STRUCTURES
Modal analysis of aircraft structures
N80-12003

New methods for ground tests of aeronautical structures
N80-12006

Practical aspects of the calculation of structural vibrations
N80-12007

A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436

AIRCRAFT TIRES
Behavior of aircraft antiskid braking systems on dry and wet runway surfaces. A slip-velocity-controlled, pressure-bias-modulated system
[NASA-TP-1051] N80-12084

AIRCRAFT WAKES
A method for assessing the impact of wake vortices of USAF operations
[AD-A072967] N80-12072

AIRFOIL PROFILES
Remarks on the transonic flow past oscillating airfoils
N80-12009

An artificial viscosity method for the design of supercritical airfoils
N80-12051

Transonic wind tunnel tests on a series of two-dimensional aerofoils in a solid wall test section
[ARL/AERO-NOTE-384] N80-12063

AIRFOILS
Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 1: Data analysis
[NASA-CR-2214] N80-12054

Transonic wind tunnel tests on a series of two-dimensional aerofoils in a solid wall test section
[ARL/AERO-NOTE-384] N80-12063

Turbulent boundary layers on an airfoil in several adverse pressure gradients
[AD-A072839] N80-12070

Aeroelastic response analysis of two dimensional, single and two degree of freedom airfoils in low-frequency, small-disturbance unsteady transonic flow
[AD-A073379] N80-12073

AIRFRAME MATERIALS
Preliminary design procedure for insulated structures subjected to transient heating
[NASA-TP-1534] N80-12438

AIRFRAMES
Real time digital model of a rolling airframe
[AD-A073456] N80-12075

Test and evaluation of graphite/epoxy composite structure
[AD-A072770] N80-12123

AIRPORTS
Aircraft noise and the market for residential housing: Empirical results for seven selected airports
[PB-297681/9] N80-12635

AIRY FUNCTION
Development of the substructural element method for stress analysis
N80-12433

ALBEDO
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data —

Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
ALGAE
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3548-01] N80-12587
ALGEBRA
On rings with self-duality
N80-12811
ALGORITHMS
Computer aided design of suboptimal constant gain filters subject to stability constraints
N80-12098
Search algorithms and related techniques for the analysis of spectrometric data
N80-12137
Design of instantaneously companded delta modulators with M-bit memory
N80-12232
An adaptive delta modulator robust to transmission errors
N80-12234
Computation of water waves
[AD-A072944] N80-12375
Simplified solution algorithms for fluid flow problems
[LA-UR-78-2813] N80-12381
Matching algorithms — for finding optimum weight perfect matching in a graph
N80-12757
A separable programming approach to the linear complementarity problem
[AD-A072928] N80-12767
Two-dimensional mesh adjustment algorithm
[AD-A073066] N80-12787
Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819
ALKALI HALIDES
Hydrostatic pressure effects on the motional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12910
ALKANES
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry — automatic test equipment
[FE-2537-9] N80-12193
ALLOCATIONS
Development of a joint-cost-allocation manual for Integrated Community Energy Systems [ICES]
[ANL/ICES-TM-20] N80-12581
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899
ALLOYS
X-ray diffraction study of the alloy system $Sm_2P_{1+x}S_{4(1-x)}$
N80-12926
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927
Theory of interstitial ordering in alloys with hexagonal close-packed crystal lattice
[IS-TRANS-106] N80-12937
ALPHA PARTICLES
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921
ALTERNATING CURRENT
Numerical computation of electromagnetic scattering by inhomogenous penetrable bodies
[AD-A073143] N80-12268
ALTERNATIVES
Rank tests for restricted alternative problems in multivariate analysis
N80-12799
ALUMINUM
Stored energy in the I sub b substage of aluminum
N80-12154
Detonation of nitromethane-Al-NO2 mixtures
N80-12206
Fracture toughness of steel-aluminum deformation welds
[SAND-78-1736] N80-12419
Study of corrosion and its control in aluminum solar collectors
[COO-2934-7] N80-12609
ALUMINUM ALLOYS
Evaluation of the use of corrosion inhibitors at the anodic oxide-metal interface
[AD-A073124] N80-12160
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
ALUMINUM OXIDES
Na beta-alumina: Structure analysis of a superionic conductor
N80-12924
AMIDES
Synthesis and photophysical properties of a fluorescent polyamide series and their monomer analogs: Novel intramolecular excimer and exciplex interactions
N80-12175
AMMONIA
Optimized chemiluminescence system for measuring atmospheric ammonia
[PB-298248/6] N80-12633
AMMONIUM COMPOUNDS
Studies on the collection and analysis of nitrite and ammonium ions in atmospheric particulate matter
N80-12618
ANALOG TO DIGITAL CONVERTERS
Bit rate reduction by automatic adaptation of quantizer step-size in DPCM systems
N80-12230
An adaptive quantizer with channel error recovery
N80-12231
ANALYSIS OF VARIANCE
Adaptive procedures in analysis of variance
N80-12795
Measuring inter-rater reliability of dichotomous responses: A components of variance approach
N80-12797
ANALYTICAL CHEMISTRY
Application of mini-and microcomputer techniques to problems in analytical chemistry
N80-12138
ANISOTROPY
Oscillations and waves in anisotropic plasmas — are analyzed using Vlasov and Maxwell equations
N80-12878
ANNEALING
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933
ANNUAL VARIATIONS
Annual mean values of geomagnetic components for selected observatories, 1940 - 1973
[PB-298716/2] N80-12653
Climate variability and the design and operation of water resource systems
N80-12678
Climatic variability and agriculture in the temperate regions
N80-12681
Climatic variability and agriculture in tropical moist regions
N80-12682
Climatic variability and agriculture in the semi-arid tropics
N80-12683
Climatic change and the exploitation of climatic resources in China
N80-12684
Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685
Climatic variability and land use: An African perspective
N80-12686
Climatic variability and forestry
N80-12687
Climatic variation and marine fisheries
N80-12688
Climatic variability, marine resources and offshore development
N80-12689
The influence of society on climate change and variability
N80-12696
Impacts of climate change and variability on society
N80-12697
Research on climatic change and variability
N80-12698
ANNULAR DUCTS
An experimental study of acoustic propagation and attenuation in a circular annular duct with a variable cross-sectional area
N80-12816
ANNULAR NOZZLES
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
ANODIC COATINGS
Evaluation of the use of corrosion inhibitors at the anodic oxide-metal interface
[AD-A073124] N80-12160
ANTENNA ARRAYS
Mutual coupling effects on a circular array of dipoles
[AD-A073077] N80-12267
ANTENNA COMPONENTS
A method for computing corrugated horns phase center
N80-12224
Analysis and synthesis of an elliptical paraboloid offset reflector antenna. An elliptically shaped beam antenna
N80-12225
Analytical and graphical methods for the design of an elliptically shaped beam antenna with elliptical paraboloid reflector
N80-12226
ANTENNA DESIGN
Space communications — conferences
N80-12216
An approach to blocked aperture synthesis
N80-12222
Analysis and synthesis of corrugated conical horns
N80-12223
A method for computing corrugated horns phase center
N80-12224
Analysis and synthesis of an elliptical paraboloid offset reflector antenna. An elliptically shaped beam antenna
N80-12225
Analytical and graphical methods for the design of an elliptically shaped beam antenna with elliptical paraboloid reflector
N80-12226
An elliptically shaped beam antenna
N80-12227
Reflector antennas with high efficiency and low depolarization
N80-12229
ANTENNA FEEDS
Reflector antennas with high efficiency and low depolarization
N80-12228
Low sidelobe level low-cost earth station antennas for the 12 GHz broadcasting satellite service
[NASA-CR-159703] N80-12259
ANTENNA RADIATION PATTERNS
A method for computing corrugated horns phase center
N80-12224
An elliptically shaped beam antenna
N80-12227
Mutual coupling effects on a circular array of dipoles
[AD-A073077] N80-12267
ANTIMONY
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
ANTISKID DEVICES
Behavior of aircraft antiskid braking systems on dry and wet runway surfaces. A slip-velocity-controlled, pressure-bias-modulated system
[NASA-TP-1051] N80-12084
APPROXIMATION
Some aspects of the approximation of free surface problems
N80-12360
Spline approximations for functional differential equations
[AD-A072763] N80-12785
Uniform approximation by rational functions having restricted denominators
[AD-A072835] N80-12786
AQUEOUS SOLUTIONS
Component relationships within two-phase gasoline/methanol/water systems
[BETC/RI-78/6] N80-12303
AQUIFERS
Transport phenomena in geological layers measurement of parameters
N80-12344
Application of porous media to heat storage underground
N80-12345
ARC LAMPS
Laser pump lamps
[AD-A072704] N80-12409
ARCHITECTURE
Architectural concerns in solar system design and installation
[SOLAR/0801-79-01] N80-12607
ARCHITECTURE [COMPUTERS]
Multiprocessor architectures for supporting secure database management
N80-12742
ARID LANDS
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
Climatic variability and agriculture in the semi-arid tropics
N80-12683
ARITHMETIC
Burst processing — in performing arithmetic
[AD-A072872] N80-12807
ARIZONA
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] N80-12547

ARPA COMPUTER NETWORK
Statistical methods for estimating time and rate parameters of digital communication
[PB-297071/3] N80-12277
ARSENIC COMPOUNDS
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121
ARTERIES
Numerical solution of a hyperbolic system of conservation laws for blood flow in the arterial tree
N80-12726
ARTIFICIAL INTELLIGENCE
Subjective understanding: Computer models of belief systems
N80-12764
ASCENT TRAJECTORIES
Effect of horizontal and vertical side forces and moments on stability of a symmetric missile in ascending or descending flight
[AD-A072808] N80-12067
ASPHALT
Relationship of asphalt cement properties to pavement durability
[PB-298833/5] N80-12245
ASSEMBLING
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/0] N80-12961
ASSEMBLY LANGUAGE
A collection of equation-solving codes for the CRAY-1 — assembly language
[AD-A073033] N80-12769
Universal P-code definition, version [0.3]
[PB-298577/8] N80-12775
ASTRODYNAMICS
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162900] N80-12979
ASTROPHYSICS
Future progress in the development of the Lick-cope
N80-12386
Research program in elementary particle theory — study of particle theory in astrophysics, electromagnetic interactions, and quantum theory
[ORO-3992-362] N80-12942
Vertical structure of galactic gaseous disks
N80-12974
ASYMPTOTIC METHODS
Adaptive procedures in analysis of variance
N80-12795
A comparative study of nonparametric methods in the randomized block design under ordered alternatives
N80-12804
ATLANTIC OCEAN
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12335
Surface meteorology over the gate a-scale
[REPT-78-6] N80-12658
Tide tables 1980. High and low water predictions. East Coast of North and South America including Greenland
[PB-298726/1] N80-12725
ATMOSPHERIC BOUNDARY LAYER
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[ERS-100255] N80-12527
ATMOSPHERIC CHEMISTRY
The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162480] N80-12623
Two-body positive ion-negative neutralization
[AD-A073145] N80-12646
ATMOSPHERIC CIRCULATION
Some results of climate experiments with numerical results
N80-12675
Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712
ATMOSPHERIC COMPOSITION
Spectrometer for the first Spacelab payload
N80-12034
The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162480] N80-12623
Global ecology and man
N80-12668
Human activities that effect climate — greenhouse effect
N80-12674
Climate models and the prediction of CO2-induced climatic changes
[ORAU/IEA-79-24-[M]] N80-12711
ATMOSPHERIC DENSITY
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
Atmosphere explorer MESA accelerometer density data base
[AD-A072851] N80-12749
ATMOSPHERIC DIFFUSION
ATMAS: A three-dimensional atmospheric transport model to trace multiple area sources
[UCRL-52603] N80-12627
ATMOSPHERIC ENTRY
Analytic theory of orbit contraction and ballistic entry into planetary atmospheres
N80-12978
ATMOSPHERIC HEAT BUDGET
Human activities that effect climate — greenhouse effect
N80-12674
ATMOSPHERIC MODELS
ATMAS: A three-dimensional atmospheric transport model to trace multiple area sources
[UCRL-52603] N80-12627
Dynamic behavior of single and multiple vortex tornadoes inferred from laboratory simulation
N80-12657
The physical basis of climate
N80-12671
Modeling of climatic changes and the problem of long-range weather forecasting
N80-12672
Some results of climate experiments with numerical results
N80-12675
Report on discussions held during the first week of the conference — world climate conference, Geneva, Jan. 1978
N80-12692
Wind resource analysis
[SERI/TR-36-088] N80-12710
Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712
ATMOSPHERIC PHYSICS
Airborn measurements of optical atmospheric properties, summary and review 3
[AD-A073121] N80-12645
ATMOSPHERIC PRESSURE
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
ATMOSPHERIC RADIATION
Routine spectral measurements of infrared radiation from the atmosphere
[LBL-8777] N80-12652
ATMOSPHERIC SCATTERING
Airborn measurements of optical atmospheric properties, summary and review 3
[AD-A073121] N80-12645
ATMOSPHERIC TEMPERATURE
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669
Aids for forecasting minimum temperature in the Wenatchee frost district
[PB-298339/3] N80-12713
The influence of cloudiness on summertime temperatures in the eastern Washington fire weather district
[PB-298674/3] N80-12716
ATOMIC ENERGY LEVELS
Temperature dependent triplet energy processes in aromatic polymers
N80-12176
ATOMIC EXCITATIONS
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
Electron-impact excitation of n = 2 levels of helium at intermediate energies
[ORO-4881-24] N80-12646
ATOMIC PHYSICS
High temperature facility for atomic physics studies — test facilities for laser heating high temperature plasmas
[UCRL-13969] N80-12640
ATOMIC STRUCTURE
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
Electron correlation and Hund's rule — study of electron states, atomic structure, and electron orbitals
N80-12830
ATOMIZING
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
ATOMS
Cascade of negative muons in atoms
[CALT-63-300] N80-12644
ATS 6
The ATS6 radio beacon pointing data: October 1975 - January 1976
[PB-297511/5] N80-12112
ATTITUDE [INCLINATION]
The normal force on a cruciform missile at bank angles of a deg and 45 deg
N80-12037
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
AUGER SPECTROSCOPY
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
AUSTENITIC STAINLESS STEELS
Austenitic stainless steel-to-ferritic steel transition joint welding for elevated temperature service
[CONF-781004-1] N80-12417
AUTOCORRELATION
Auto- and cross-correlation of image coordinates
N80-12456
On the relationship between the R and S arrays and the Box-Jenkins method of ARMA model identification
[AD-A072934] N80-12769
AUTOMATA THEORY
Language recognition and the synchronization of cellular automata
N80-12759
Good functions, elementary sets and automata
N80-12813
AUTOMATIC CONTROL
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/0] N80-12961
AUTOMATIC FLIGHT CONTROL
Sea King Mk. 50 helicopter flight control system. A mathematical model of the AFCS [autostabilizer/autopilot mode]
[ARL/AERO-NOTE-387] N80-12099
AUTOMATIC PILOTS
Sea King Mk. 50 helicopter flight control system. A mathematical model of the AFCS [autostabilizer/autopilot mode]
[ARL/AERO-NOTE-387] N80-12099
AUTOMATIC TEST EQUIPMENT
A new method of electric measurement of crack length
N80-12018
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry — automatic test equipment
[PE-2537-9] N80-12193
Minicomputer applications in automated testing of electro-optical guidance systems
[AD-A073092] N80-12407
AUTOMATION
Recent automation changes in model velocity analyses and data acquisition by miniature price meters
[AD-A072692] N80-12751
AUTOMOBILE FUELS
Environmental aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12201
AUTOMOBILES
Automobile fuel tanks — bibliography
[PB-299933/3] N80-12421
Research on the dynamics of band-supported flywheel systems
[SAND-78-7074] N80-12597
Rational ways to increase pictographic symbol discriminability
N80-12734
Demand for special performance vehicles, 1975 - 2025
[UCRL-13911] N80-12960
AUTORADIOGRAPHY
Autoradiographic enhancement of Polaroid film
[UCRL-13955] N80-12401
AUTOREGRESSIVE PROCESSES
Estimation of the order of an autoregressive time series - a Bayesian approach
N80-12803
AVIONICS
F-111 A/E digital bomb-nav system software analysis
[AD-A072826] N80-12089
Validation Methods for Fault-Tolerant avionics and control systems, working group meeting 1
[NASA-CP-2114] N80-12741
AXIAL FLOW
Multiple-mirror axial confinement using the fluid model
[LA-7580-MS] N80-12890
AXIAL LOADS
A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429
AXIAL STRESS
Effects of uniaxial stress on excitons in cuprous oxide
N80-12909

B

BACKSCATTERING
Subsurface electromagnetic target characterization and identification
[AD-A072491] N80-12272
Single crystal defect studies by means of ion channeling
N80-12917

BALLISTIC MISSILES
Test and evaluation of graphite/epoxy composite structure
[AD-A072779] N80-12123
Data acquisition and transmission from highly accelerated ballistic missiles of small and medium calibre — using miniaturized sensors and transmission systems
N80-12315
The 1930ADT GSRS, missile no. 1031, round no. V-46
[AD-A073308] N80-12699
BALLISTIC TRAJECTORIES
The development of passive Doppler techniques in LRSL/ISL and their applications to ballistic and aerodynamic measurements
N80-12210
BALLISTICS
Contributions to ballistics, detonations, and pulse physics
[BMVG-FBWT-79-01] N80-12205
BARIUM COMPOUNDS
Preparation and comparison of the photoelectric properties of $Sr2Nb2O7$ and $Ba0.5Sr0.5Nb2O6$
[AD-A073192] N80-12935
BARREN LAND
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
BARRIER LAYERS
Analysis of latch-up prevention in CMOS IC's using an epitaxial-buried layer process
[SAND-78-1648] N80-12292
BAYES THEOREM
Estimation of the order of an autoregressive time series - a Bayesian approach
N80-12803
BAYS
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
BEACHES
The first five years of coastal zone management
[PB-298780/7] N80-12723
BEAMS [RADIATION]
Method for shaping and aiming narrow beams — using a linear frequency chirp for sonar reception
[NASA-CASE-NPO-14632-1] N80-12256
BEAMS [SUPPORTS]
Buckling and post-buckling behavior of elasto-plastic structures
N80-12430
Hysteretic behavior of lightweight reinforced concrete beam-column subassemblages
[PB-298267/6] N80-12451
BEARING [DIRECTION]
The ATS6 radio beacon pointing data: October 1975 - January 1976
[PB-297511/8] N80-12112
BEDS [PROCESS ENGINEERING]
Transport phenomena in packed bed reactors
N80-12339
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
General and particular aspects of the particulate bed behaviour in the Post Accident Heat Removal situation for Liquid Metal Fast Breeder Reactors
N80-12349
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350
Hot spot phenomena in active packed beds
N80-12351
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352
BELGIUM
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
BENDING THEORY
Small-scale yielding at the tip of a through-crack in a shell
[AD-A072832] N80-12442
BETA PARTICLES
Directional distributions of beta-rays emitted from oriented nuclei
N80-12849
BIBLIOGRAPHIES
Aeronautical engineering. A continuing bibliography with indexes, supplement 114
[NASA-SP-7037[114]] N80-11999
Application of advanced on-board processing concepts to future satellite communications systems: Bibliography
[NASA-CR-159684] N80-12261
Automobile fuel tanks — bibliography
[PB-299933/3] N80-12421
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899
Better information management policies needed: A study of scientific and technical bibliographic services
[PB-296776/6] N80-12953
BINARY ALLOYS
Magnetic susceptibility of chromium and its alloys
N80-12155
BINARY MIXTURES
Ultrasonic velocity and absorption measurements in several binary mixtures with pyridine
N80-12817
The transport properties of dilute gases in applied fields
N80-12906
BINARY STARS
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80588] N80-12989
BIOCLIMATOLOGY
Climatic change and human strategy
N80-12667
Global ecology and man
N80-12668
Climate, health and disease
N80-12679
BIOINSTRUMENTATION
Design of a microprocessor based cardiotachometer
[AD-A073105] N80-12731
BIOLOGICAL EFFECTS
Combined effects of polycyclic aromatic hydrocarbons and sunlight — on Chinese hamster V79 cells
[CONF-790447-4] N80-12631
BIOMASS
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10006] N80-12524
Analysis of coastal upwelling and the production of a biomass
[NASA-TM-78614] N80-12720
BIOMASS ENERGY PRODUCTION
Cost analysis of aquatic biomass systems
[HCP/ET/4000-78/1] N80-12202
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3548-01] N80-12587
BIOMEDICAL DATA
Human muscle fiber types in power lifters, distance runners and untrained subjects: A histochemical and ultrastructural study
N80-12727
BIOMETRICS
A postural measurement system for induced body sway assessment
N80-12729
Design of a microprocessor based cardiotachometer
[AD-A073105] N80-12731
BIONICS
Numerical solution of a hyperbolic system of conservation laws for blood flow in the arterial tree
N80-12726
A postural measurement system for induced body sway assessment
N80-12729
BIOSPHERE
Global ecology and man
N80-12668
The physical basis of climate
N80-12671
BIPOLAR TRANSISTORS
Electrical overstress program
[AD-A073148] N80-12422
BIRD-AIRCRAFT COLLISIONS
An evaluation of the bird/aircraft strike hazard at selected United Kingdom bases: RAF Mildenhall, RAF Alconbury, RAF Upper Heyford, RAF Bentwaters, RAF Fairford, RAF Lakenheath, and RAF Woodbridge
[AD-A073062] N80-12077
BIREFRINGENCE
Oscillatory flow birefringence measurements of block copolymers in solution
N80-12174
BISMUTH ALLOYS
The magnetic susceptibility of the liquid bismuth-indium alloy system
N80-12126
BISMUTH COMPOUNDS
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605
BIVARIATE ANALYSIS
Effects of categorization on relationships in bivariate distributions and applications to rating scales
N80-12796
Towards reconstruction of an un-paired random sample — from a bivariate normal distribution
N80-12798
BLACK BODY RADIATION
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-13020
BLACK HOLES [ASTRONOMY]
Black holes and cosmic censorship
N80-12977
BLADE TIPS
ONERA aerodynamic research work on helicopters
N80-12080
BLANKETS [FUSION REACTORS]
LASL thermochemical hydrogen program status on October 31, 1978 — fusion-synfuel
[LA-UR-78-2895] N80-12397
BLOCK DIAGRAMS
Design and measurement of implementation schemes for retention storage management as utilized in block structured languages
N80-12762
BLOOD FLOW
Numerical solution of a hyperbolic system of conservation laws for blood flow in the arterial tree
N80-12726
BLUNT BODIES
Improvements to the solution of the viscous shock layer equations
[AD-A072675] N80-12071
Preliminary design aerodynamic prediction methodology for missiles with nose bluntness
[AD-A073664] N80-12111
BODIES OF REVOLUTION
A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429
BODY KINEMATICS
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
BODY-WING AND TAIL CONFIGURATIONS
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
The normal force on a cruciform missile at bank angles of a deg and 45 deg
N80-12037
Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-intakes
N80-12038
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
Wind tunnel investigation of an oblique wing transport model at mach numbers between 0.6 and 1.4
[NASA-CR-137697] N80-12059
BOILERS
Solar-powered steam generator heliostat
[BNL-50974] N80-12690
BONDING
Increased fracture toughness of graphite-epoxy composites through intermittent interlaminar bonding
N80-12119
Bond stress-slip relationship and cracking response of reinforced concrete composite
[PB-297744/5] N80-12432
BORON
Very shallow p-n junctions with boron-rich layers and applications as high efficiency p+/n photovoltaic junctions
N80-12915
BOUNDARY LAYER CONTROL
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818
Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819
BOUNDARY LAYER EQUATIONS
Higher-order boundary layer equations for three-dimensional compressible flow
N80-12048
Solutions of Prandtl's boundary layer equations using linear programming and mappings
N80-12302
Computational aspects of viscous flows — numerical analysis of viscous flow and the relationship of the boundary layer equations to the navier-stokes equation
N80-12371
BOUNDARY LAYER FLOW
An experimental and analytical study of boundary layers in highly turbulent freestreams
[AD-A073006] N80-12376
A generalized base-flow analysis with initial boundary-layer and chemistry effects
[AD-A072683] N80-12377
BOUNDARY LAYER SEPARATION
Separation of a flow along a line of a smooth surface
N80-12022

La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-508] N80-12029
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
BOUNDARY LAYER STABILITY
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
BOUNDARY LAYER TRANSITION
A computational method for calculating laminar-turbulent transition in a boundary layer
N80-12047
BOUNDARY LAYERS
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefied hypersonic flow
N80-12050
BOUNDARY VALUE PROBLEMS
Computational Fluid Dynamics
[VKI-LEC-SER-1979-4] N80-12358
Numerical methods for hyperbolic partial differential equations
N80-12359
Some aspects of the approximation of free surface problems
N80-12360
Order of accuracy and boundary conditions for large scale time dependent partial differential equations
N80-12361
The computation of three dimensional viscous flows
N80-12362
On some problems in two and single phase flows
N80-12363
The numerical treatment of compressible high Reynolds number flows
N80-12364
A simplified model for the viscous crossflow in a slotted test section
[NASA-CR-3206] N80-12372
OASIS: A general purpose mesh generator for finite element codes
[M-101] N80-12449
Two-dimensional mesh adjustment algorithm
[AD-A073060] N80-12787
Direct and inverse error estimates for finite elements with mesh refinements
[ORO-3443-81] N80-12793
Block relaxation techniques for finite-element elliptic equations: An example
[LA-7870-MS] N80-12794
BRAZIL
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10005] N80-12519
BREEDER REACTORS
Economics of fusion driven synthetic energy systems
[CONF-790602-58] N80-12602
BRIDGES [STRUCTURES]
Bridge deck joint-sealing system: Evaluation and performance specification
[PB-298942/4] N80-12184
Durability of concrete bridge decks
[PB-298829/3] N80-12247
BRIGHTNESS
Field electron and ion source research for high density information storage system
[AD-A073701] N80-12286
Some contemplated improvements to the prototype Linicope
N80-12389
BRILLOUIN EFFECT
Brillouin scatter in a hydrodynamic simulation
[UCRL-82793] N80-12874
BRUSH [BOTANY]
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
BUCKLING
Postbuckling studies of curved laminated composite panels
N80-12434
BUILDINGS
Linear and nonlinear earthquake responses of simple torsionally coupled systems
[PB-298262/7] N80-12450
BURNING RATE
Investigation of critical burning of fuel droplets
[NASA-CR-159697] N80-12142
Burning velocities of a solid propellant, via a microwave technique, at elevated pressures and pressurization rates
N80-12187
BURSTS
Burst processing — in performing arithmetic
[AD-A072872] N80-12807
Detection of a fast, intense and unusual gamma ray transient
[NASA-TM-80570] N80-12983

C

C BAND
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10026] N80-12530
CADMIUM
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing
[PB-298841/0] N80-12173
CALIBRATING
Bundle adjustment with field and self calibration: Recent results
N80-12461
Progress in photogrammetric point determination by compensation of systematic errors and detection of gross errors
N80-12462
Block-adjustment programs for minicomputers
N80-12464
Interim calibration report for the EMMR simulator
[NASA-TM-80566] N80-12534
CALIFORNIA
Residential on site solar heating systems. A project evaluation using the capital asset pricing model
[LBL-8295] N80-12581
Analysis of the California solar resource, volume 2
[LBL-7949-VOL-2] N80-12589
Environmental aspects of alternative energy technologies for California
[UCRL-15002] N80-12628
CAMEROON
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
CAPACITORS
Study program for constant current capacitor charging method
[UCRL-13914] N80-12297
CARBON DIOXIDE
Naturally occuring carbon dioxide sources in the United States. A geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery
[PE-2025-38] N80-12624
CARBON DIOXIDE CONCENTRATION
What role can simulation model predictions play in environmental decisions: Carbon dioxide as an example
[CONF-790448-1] N80-12632
Climatic models and the prediction of CO2-induced climatic changes
[ORAU/IEA-78-24-[M]] N80-12711
CARBON DIOXIDE LASERS
Experimental studies of laser induced detonation waves
N80-12214
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404
CARBON STEELS
Fracture toughness characterization of selected ultra high carbon steels
[AD-A073395] N80-12159
CARBONACEOUS MATERIALS
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2247-2] N80-12191
CARBONATES
Commercial application of molten carbonate fuel cell system
[CONF-790213-4] N80-12557
CARBONYL COMPOUNDS
Ion electrodes selective for organic functional groups
N80-12114
CARDIOGRAMS
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730
CARDIOTACHOMETERS
Design of a microprocessor based cardiotachometer
[AD-A073105] N80-12731
CARNOT CYCLE
Comments on the derivation of the Carnot efficiency according to Max Planck: Thermodynamics [eleventh edition] De Groyter 1964 and R. Clausius: Mechanical heat theory [third edition] Vieweg 1887
[UCRL-TRANS-1572] N80-12948
CASCADE FLOW
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015
Calculation - experiment comparisons of the transonic two-dimensional flow in a high-deflection cascade
N80-12016
Blade wake interference: Temperature effect — on cascade flow
N80-12335
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
CASSEGRAIN ANTENNAS
An approach to blocked aperture synthesis
N80-12222
CASTING
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166
CAVITATION FLOW
Leading edge flutter of supercavitating hydrofoils
[AD-A073342] N80-12236
CELLS
Heated electron beam cell study
[AD-A072875] N80-12410
CELLS [BIOLOGY]
Combined effects of polycyclic aromatic hydrocarbons and sunlight — on Chinese hamster V79 cells
[CONF-790447-4] N80-12631
CENTER OF PRESSURE
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
CENTRAL AMERICA
Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685
CENTRAL ATLANTIC REGION [US]
National Energy Act of 1978: A regional assessment
[PB-296479/9] N80-12615
CENTRAL PROCESSING UNITS
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10026] N80-12530
CENTRIFUGES
Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/6] N80-12402
CEPHEID VARIABLES
Theoretical light and velocity curves for Cepheid variables
[LA-7994-MS] N80-12971
CERAMICS
Replication technique for examining defects in the interface of a metal-to-glass ceramic bond
[GE/PP-TIS-391] N80-12182
CERIUM
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927
CHANNEL FLOW
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319
CHANNEL MULTIPLIERS
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TP] N80-12891
CHANNELS [DATA TRANSMISSION]
The NASA bus communications listening device software
[NASA-CR-160346] N80-12258
CHARGE CARRIERS
Transport theory of carriers across semiconductor heterojunction interfaces
N80-12280
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933
CHARGE TRANSFER
Experimental study of low-energy charge transfer in nitrogen
[NASA-TM-80156] N80-12398
CHARGED PARTICLES
Cascade of negative muons in atoms
[CALT-63-300] N80-12844
CHEMICAL ANALYSIS
Studies on the collection and analysis of nitrite and ammonium ions in atmospheric particulate matter
N80-12618
CHEMICAL ATTACK
Electroless [chemispheretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141
CHEMICAL BONDS
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833
CHEMICAL CLEANING
Preparation and characterization of latexes
N80-12115
CHEMICAL EFFECTS
Predictions of the effects on the stratosphere of changes in the oxides of nitrogen
[UCRL-82553] N80-12651

CHEMICAL ELEMENTS
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
CHEMICAL EQUILIBRIUM
Materials problems in reversible chemical reaction storage systems for solar energy
[SAND-78-8693] N80-12574
CHEMICAL FRACTIONATION
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
CHEMICAL REACTIONS
The methanation reaction on ruthenium thin films: A mechanistic investigation
N80-12128
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379
CHEMICAL REACTORS
HYGAS process update
[CONF-781045-6] N80-12200
CHEMILUMINESCENCE
Kinetic spectroscopy of metal atom/oxidizer chemiluminescent reactions for laser applications
[AD-A073082] N80-12411
Optimized chemiluminescence system for measuring atmospheric ammonia
[PB-298248/6] N80-12633
CHEMISORPTION
Electroless [chemiphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141
CHINESE PEOPLES REPUBLIC
Climatic change and the exploitation of climatic resources in China
N80-12684
CHIPS [MEMORY DEVICES]
Metal-Nitride-Oxide-Semiconductor [MNOS] radiation characterization studies
[AD-A073637] N80-12287
CHIRP SIGNALS
Method for shaping and aiming narrow beams — using a linear frequency chirp for sonar reception
[NASA-CASE-NPO-14632-1] N80-12256
CHLORIDES
The crystal and molecular structure of trimethylsin chloride at 135 K, a highly volatile organosin polymer
[AD-A073641] N80-12180
CHLOROPHYLLS
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12535
CHROMIUM
Evaluation of high chromium overplays to protect less alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163
NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165
CHROMIUM ALLOYS
Magnetic susceptibility of chromium and its alloys
N80-12155
CIRCUIT BOARDS
Solderability — printed circuit boards and copper surfaces
[SAND-78-1749C] N80-12169
CIRCUIT DIAGRAMS
Research study: Device technology STAR router user's guide — automated layout of large scale integration discretionary interconnection masks
[NASA-CR-161213] N80-12765
CIRCUIT PROTECTION
Hemp study of planned DAS3 configuration
[AD-A072946] N80-12265
CIRCUMSOLAR RADIATION
Circumsolar radiation data for central receiver simulation
[LBL-8371] N80-12647
Measurement of circumsolar radiation: Status report
[LBL-8391] N80-12982
CITIES
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-13487
Baltimore applications project
[NASA-TM-80577] N80-12957
Houston Conference on the Revitalization of the Inner City
[PB-298906/9] N80-12965
CIVIL AVIATION
Federal Aviation Act of 1958
N80-12954
CLADDING
Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation
[TFBP-TR-292] N80-12164
CLAMPS
Experimental and theoretical investigation of pipe riser clamps
N80-12428
CLASSICAL MECHANICS
Semiclassical statistical mechanics
[LBL-9095] N80-12947
CLASSIFICATIONS
Classification of agricultural land with the aid of remote sensing methods
N80-12495
Maximum likelihood estimation of label imperfections and its use in the identification of mislabeled patterns
[NASA-CR-160364] N80-12805
CLIMATE
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
Climate at the millennium
N80-12666
Climatic change and human strategy
N80-12667
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
Human activities that effect climate — greenhouse effect
N80-12674
Some results of climate experiments with numerical results
N80-12675
A scenario of possible future climates: Natural and man-made
N80-12676
Energy and climate: A review with emphasis on global interactions
N80-12677
Climate variability and the design and operation of water resource systems
N80-12678
Climate, health and disease
N80-12679
Climatic variability and agriculture in the temperate regions
N80-12681
Climatic variability and agriculture in tropical moist regions
N80-12682
Climatic variability and agriculture in the semi-arid tropics
N80-12683
Climatic change and the exploitation of climatic resources in China
N80-12684
Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685
Climatic variability and land use: An African perspective
N80-12686
Climatic variability and forestry
N80-12687
Climatic variation and marine fisheries
N80-12688
Climatic variability, marine resources and offshore development
N80-12689
Climate and economic activity
N80-12690
Climate and society: Lessons from recent events
N80-12691
Climate data
N80-12694
The influence of society on climate change and variability
N80-12696
Impacts of climate change and variability on society
N80-12697
Research on climatic change and variability
N80-12698
Solar-climatic statistical study. Summary report, volume 1
[HCP/T4016-1] N80-12707
Climate models and the prediction of CO2-induced climatic changes
[ORAU/IEA-78-24-[M]] N80-12711
Proceedings of the annual climate diagnostics workshop — covering ocean related climate characteristics
[PB-298355/9] N80-12717
CLIMATOLOGY
Climates of past geological epochs — paleogeography
N80-12670
The physical basis of climate
N80-12671
Modeling of climatic changes and the problem of long-range weather forecasting
N80-12672
Report on discussions held during the first week of the conference — world climate conference, Geneva, Jan. 1978
N80-12692
The declaration of the World Meteorological Conference: An appeal to nations
N80-12693
Applications of the knowledge of climate
N80-12695
CLINICAL MEDICINE
A comparison of the Liniscope with other X-ray imaging systems
N80-12390
Pediatrics
N80-12395
Podiatry
N80-12396
CLOSED CYCLES
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-195-010] N80-12291
Closed-cycle hydride engines
[SAND-78-2228] N80-12572
CLOSED ECOLOGICAL SYSTEMS
Evaluation and comparison of alternative designs for water/solid-waste processing systems for spacecraft
[NASA-CR-162492] N80-12739
CLOSURE LAW
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
CLOUD CHAMBERS
Laboratory investigations of cloud forming nuclei and aerosol particles from superaerated burns of space shuttle propellant
[NASA-CR-160356] N80-12664
CLOUD COVER
The influence of cloudiness on summertime temperatures in the eastern Washington fire weather district
[PB-298674/3] N80-12716
CLOUD PHYSICS
An investigation of the acidity of stratus cloud water and its relationship to droplet distribution, pH of rain, and weather parameters
N80-12616
The role of coalescence nuclei in warm rain initiation
[PB-298556/2] N80-12654
Collection and measurement efficiencies of the EWER cloud water meter for hydrometeors
[AD-A072827] N80-12700
CMOS
Analysis of latch-up prevention in CMOS IC's using an epitaxial-buried layer process
[SAND-78-1648] N80-12292
COAL
Automated longwall guidance and control systems, phase 1
[NASA-CR-161329] N80-12538
Automated longwall guidance and control systems, phase 2, part 2: Vertical control system [VCS]
[NASA-CR-161330] N80-12539
Automated longwall guidance and control systems, phase 2, part 2: RCS, FAS, and MCS
[NASA-CR-161331] N80-12540
Applications of solid state nuclear magnetic resonance techniques to the study of coals and polymers
[IS-T-822] N80-12838
COAL GASIFICATION
Evaluation of high chromium overplays to protect less alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163
HYGAS process update
[CONF-781045-6] N80-12200
Environmental assessment report: Large coal gasification systems for SNG
[PB-298109/0] N80-12204
COAL LIQUEFACTION
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2247-2] N80-12191
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1028] N80-12192
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Mass spectrometry and fossil-energy conversion technology: A review
[FE-2537-7] N80-12198
COAL UTILIZATION
Commercial application of molten carbonate fuel cell system
[CONF-790213-6] N80-12557
Comparison of geothermal energy with coal, oil, and natural gas for selected uses
[DOE/ET-27139-1] N80-12558
COALESCING
The role of coalescence nuclei in warm rain initiation
[PB-298556/2] N80-12654
COASTAL CURRENTS
Determination of currents in coastal regions using multispectral scanning images
N80-12476
An analysis of longshore currents and associated sediment transport in the surf zone
[PB-298291/6] N80-12724
COASTAL ECOLOGY
Water quality in coastal region: Evaluation of thermal images of factory water coolant inlets
N80-12477
COASTAL PLAINS
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] N80-12722

COASTS
Analysis of coastal upwelling and the production of a biomass
[NASA-TM-78634] N80-12720
The first five years of coastal zone management
[PB-298780/7] N80-12723
COBALT ALLOYS
Ductility minimum and its reversal with aging in cobalt-base superalloys
[ORNL/TM-6624] N80-12170
COGNITION
Skimming stories in real time: An experiment in integrated understanding
N80-12763
Subjective understanding: Computer models of belief systems
N80-12764
COHERENT SCATTERING
Analysis of Coherent Anti-Stokes Raman Spectra: Determination of molecular parameters
N80-12829
Coherence studies in the first electronic excited singlet state of solid naphthalene
N80-12920
COLLISIONS
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162500] N80-12979
COLOR TELEVISION
Transform coding of PAL composite signals
N80-12235
COLORIMETRY
Determination of the optical properties of the sea in the German bight
N80-12516
COLUMNS [SUPPORTS]
The effect of pre-cracking on column behaviour
[PB-298743/5] N80-12439
Hysteretic behavior of lightweight reinforced concrete beam-column subassemblages
[PB-298267/6] N80-12451
COMBUSTIBLE FLOW
Analysis and modelling of the flow within a turbomachine combustor
N80-12024
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
Models of turbulent combustion for numerical predictions
N80-12324
COMBUSTION
Investigation of critical burning of fuel droplets
[NASA-CR-159697] N80-12142
Flame - a slow-flow combustion model
[AD-A072980] N80-12145
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073050] N80-12146
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
COMBUSTION CHAMBERS
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-519] N80-12021
Analysis and modelling of the flow within a turbomachine combustor
N80-12024
Premixing quality and flame stability: A theoretical and experimental study
[NASA-CR-3216] N80-12090
Influence of turbulence on hydrocarbon combustion in a stirred combustor
[ESA-TT-580] N80-12151
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
COMBUSTION EFFICIENCY
Results of duct area ratio changes in the NASA Lewis H2-O2 combustion MHD experiment
[NASA-TM-79308] N80-12881
COMBUSTION PHYSICS
Laser-Raman spectroscopy
N80-12041
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
Models of turbulent combustion for numerical predictions
N80-12324
Laser velocimeter measurements in a constant volume internal combustion engine simulator
[SAND-78-8721] N80-12400
Toward a comprehensive model for combustion in a direct injection stratified charge engine
[LA-UR-78-3223] N80-12418
COMBUSTION PRODUCTS
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1028] N80-12192
COMMERCE
Shale oil: US and world resources and prospects for near-term commercialization in the United States
[ORAU/IEA-79-8[R]] N80-12544
COMMERCIAL AIRCRAFT
Federal Aviation Act of 1958
N80-12954
COMMERCIAL ENERGY
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580
COMMUNICATION EQUIPMENT
Reliability performances of systems with a switching matrix
N80-12217
COMMUNICATION NETWORKS
The NASA bus communications listening device software
[NASA-CR-160384] N80-12258
Background storage management in operating systems for communications computers
[ESA-TT-500] N80-12755
COMMUNICATION SATELLITES
The telecommunication satellite as an integrated time division transmission-switching system
N80-12220
Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits
N80-12221
Naval blue-green single-pulse downlink propagation model
[AD-A071780] N80-12406
COMMUNICATION THEORY
The effectiveness of two and three dimensional isarithmic surfaces in communicating magnitude, gradient, and pattern information
N80-12454
COMPILERS
Compiling customized executable representations and interpreters
N80-12744
Universal P-code definition, version [0.3]
[PB-298577/8] N80-12775
COMPONENT RELIABILITY
Investigation of moisture measurements, failure rate and leak rate and a study of moisture infusion
[PB-299172/7] N80-12299
COMPOSITE FUNCTIONS
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
COMPOSITE MATERIALS
Effect of constituent properties on composite strength
[UCRL-83051] N80-12124
Bond stress-slip relationship and cracking response of reinforced concrete composite
[PB-297344/5] N80-12452
COMPOSITE STRUCTURES
Postbuckling studies of curved laminated composite panels
N80-12434
COMPRESSIBILITY EFFECTS
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
COMPRESSIBLE FLOW
Mixing length model for compressible turbulent flows in rough channels
N80-12044
Higher-order boundary layer equations for three-dimensional compressible flow
N80-12048
The numerical treatment of compressible high Reynolds number flows
N80-12364
COMPRESSION LOADS
Postbuckling studies of curved laminated composite panels
N80-12434
COMPRESSOR BLADES
High speed blade-wake interactions — in axial flow turbomachines
N80-12336
COMPRESSOR ROTORS
Flow measurements in a rotating stall cell
N80-12334
COMPRESSORS
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
COMPUTATIONAL FLUID DYNAMICS
Aerodynamic characteristics of a hypersonic research airplane concept having a 70 deg sweep double-delta wing at Mach numbers from 0.80 to 1.20, with summary of data from 0.20 to 6.0 — Langley 8-ft transonic wind tunnel
[NASA-TP-1552] N80-12064
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
Second order modeling of turbulent flows
N80-12318
Direct numerical simulation of turbulence
N80-12320
Pathological cases in turbulent field and spectral approach
N80-12321
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
Models of turbulent combustion for numerical predictions
N80-12324
Computational Fluid Dynamics
[VKI-LEC-SER-1979-4] N80-12358
A simplified model for the viscous crossflow in a ducted test section
[NASA-CR-3206] N80-12372
COMPUTER GRAPHICS
High-speed graphics terminal interface for a PDP-11 minicomputer
[LA-7840-MS] N80-12754
Interactive use of computer drawn faces to study multidimensional data
[LA-7752-MS] N80-12774
Inversion of isoparametric mappings and applications of computer graphics to three dimensional finite element analyses
[AD-A073013] N80-12791
COMPUTER NETWORKS
The NASA bus communications listening device software
[NASA-CR-160384] N80-12258
Background storage management in operating systems for communications computers
[ESA-TT-500] N80-12755
COMPUTER PROGRAMMING
Height interpolation by the method of finite elements
N80-12460
Automatic data acquisition for digital height model
N80-12465
Language recognition and the synchronization of cellular automata
N80-12759
Quality considerations in a programming language
N80-12760
Programming in HAL/S
[NASA-CR-162501] N80-12766
Generating correct programs from logic specifications
[AD-A073023] N80-12771
Inversion of isoparametric mappings and applications of computer graphics to three dimensional finite element analyses
[AD-A073013] N80-12791
COMPUTER PROGRAMS
A program for calculating load coefficient matrices utilizing the force summation method, L218
[LOADS, Volume I: Engineering and usage
[NASA-CR-2853] N80-12056
Random harmonic analysis program, L221
[TEV156, Volume I: Engineering and usage
[NASA-CR-2857] N80-12058
Analyst level documentation for the search and rescue simulation [Servim]
[AD-A073155] N80-12078
F-111 A/E digital bomb-nav system software analysis
[AD-A072826] N80-12089
IGOS improvements for Seasat
[NASA-CR-162604] N80-12307
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 2: Numerical evaluation
[AD-A072990] N80-12269
Ground wave propagation over irregular, inhomogeneous terrain: Comparisons of calculations and measurements
[PB-298668/5] N80-12278
An introduction to the BANNING design automation system for shuttle microelectronic hardware development
[NASA-TM-80831] N80-12282
Transient 3-d eddy current in multiple conductors
[CONF-790738-2] N80-12295
OASIS: A general purpose mesh generator for finite element codes
[M-101] N80-12449
Block-adjustment programs for minicomputers
N80-12464
Compiling customized executable representations and interpreters
N80-12744
Subjective understanding: Computer models of belief systems
N80-12764
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768
Generating correct programs from logic specifications
[AD-A073023] N80-12771
Assessment of procedures and preliminary software design for fault tree synthesis
[UCRL-13919] N80-12773
User's manual for the magnetohydrodynamic generator channel code, MHDCHN
[SAND-78-1260] N80-12894
Mechanical intelligence: Research and applications
[AD-A073127] N80-12952
COMPUTER STORAGE DEVICES
Directions for memory hierarchies and their components: Research and development
[LBL-8276] N80-12752

Large mass storage facility — for computers
[BNL-50900] N80-12753
Background storage management in operating systems for communications computers
[ESA-TT-500] N80-12755
Design and measurement of implementation schemes for retention storage management as utilized in block structured languages
N80-12762

COMPUTER SYSTEMS DESIGN
Central Computational Facility CCF communications subsystem options
[NASA-CR-160383] N80-12257
Validation Methods for Fault-Tolerant avionics and control systems, working group meeting 1
[NASA-CP-2114] N80-12741
Multiprocessor architectures for supporting secure database management
N80-12742
Directions for memory hierarchies and their components: Research and development
[LBL-8276] N80-12752

COMPUTER SYSTEMS PROGRAMS
Equation modifying program, L219 [EQMOD]. Volume 1: Engineering and usage
[NASA-CR-2855] N80-12057
The NASA bus communications listening device software
[NASA-CR-160384] N80-12258
IMS 11: An Information on Management System for the PDP 11 computer
[PB-298731/1] N80-12756
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768

COMPUTER TECHNIQUES
Application of mini-and microcomputer techniques to problems in analytical chemistry
N80-12138
A communications trade-off study for computerized traffic control. Volume 2: Appendixes
[PB-298844/7] N80-12967

COMPUTERIZED DESIGN
An artificial viscosity method for the design of supercritical airfoils
N80-12051
Inertia calculation procedure for preliminary design
[AD-A072679] N80-12087
Computer aided design of suboptimal constant gain filters subject to stability constraints
N80-12098
An approach to blocked aperture synthesis
N80-12222
An introduction to the BANNING design automation system for shuttle microelectronic hardware development
[NASA-TM-80831] N80-12282
AFAL simulation facility/capability manual. Volume 2: Executive summary. Computer aided design for microelectronics
[AD-A073383] N80-12283
Optimization of computer automated ultrasonic inspection system
[AD-A072677] N80-12423
Implications of an all-digital Navy technical information presentation system
[AD-A073095] N80-12951

COMPUTERIZED SIMULATION
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
Analyst level documentation for the search and rescue simulation [Sarsim]
[AD-A073155] N80-12078
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629
Some potential effects of acid rain on forest ecosystems: Implications of a computer simulation
[BNL-50889] N80-12630
What role can simulation model predictions play in environmental decisions: Carbon dioxide as an example
[CONF-790468-1] N80-12632
Some results of climate experiments with numerical results
N80-12675
A parametric management tool for estimating simulator software size
[AD-A07J015] N80-12768
Brillouin scatter in a hydrodynamic simulation
[UCRL-82793] N80-12874
Experiments on the ZT-S reversed-field pinch, August - December 1978
[LA-7862-MS] N80-12885

COMPUTERS
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899

CONCRETES
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185
Reinforcement to control thermal and shrinkage cracking
[PB-298412/8] N80-12237
Recent concepts: Their influence on code predictions of shrinkage and creep — in concrete
[PB-298413/6] N80-12238
Failure and repair of continuously reinforced concrete pavement
[PB-298832/7] N80-12246
Durability of concrete bridge decks
[PB-298829/3] N80-12247
Performance of continuously reinforced concrete pavement in Illinois
[PB-298495/3] N80-12249
An evapo-transmission method for determining relative permeability of concrete
[PB-298323/7] N80-12251
The effect of pre-cracking on column behaviour
[PB-298743/6] N80-12439
Hysteretic behavior of lightweight reinforced concrete beam-column subassemblages
[PB-298267/6] N80-12451
Bond stress-slip relationship and cracking response of reinforced concrete composite
[PB-297744/5] N80-12452
Fracture behavior and analysis of fiber reinforced concrete beams
[PB-297743/7] N80-12453

CONDUCTION
Na beta-alumina: Structure analysis of a superionic conductor
N80-12924

CONDUCTIVE HEAT TRANSFER
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526

CONDUCTIVITY
High pressure studies of ionic conductivity in solids — high pressure study of ionic mobility and conductivity in crystal lattices
[SAND-79-1511C] N80-12943

CONFERENCES
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing
[PB-298841/8] N80-12173
Space communications — conferences
N80-12216
Proceedings of the 1978 Electromagnetic Interference Workshop
[PB-298675/0] N80-12279
Preliminary applications and evaluation results. Lixicope: Proceedings of the Lixicope Conference
[NASA-CP-2112] N80-12384
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[BMFT-FB-W-78-04] N80-12467
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[WMO-537] N80-12665
Proceedings of the annual climate diagnostics workshop — covering ocean related climate characteristics
[PB-298355/9] N80-12717
Guiding the development of a controlled ecological life support system
[NASA-CR-162452] N80-12735
AGARD bulletin technical programme, 1980
[AGARD-BULL-79/2] N80-12990

CONGRESSIONAL REPORTS
Inventory of advanced energy technologies and energy conservation research and development, 1976-1978, volume 1
[GPO-41-481] N80-12550
Aviation Safety and Noise Abatement Act of 1979
[S-REPT-96-52] N80-12621
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12660
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] N80-12722
Federal Aviation Act of 1958
N80-12954
Policy Coordination Group for technology development
[GPO-31-469] N80-12956

CONICAL NOZZLES
Dimensions of a coherent structure in the potential cone of a subsonic free jet
N80-12313

CONSTRUCTION
Construction problems for high Reynolds number wind tunnel models
[ESA-TT-564] N80-12101

CONTAINERS
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183

CONTAMINANTS
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183

CONTINENTS
Climates of past geological epochs — paleogeography
N80-12670

CONTINUUM MECHANICS
System theory as applied differential geometry — linear system
[NASA-CR-3209] N80-12776

CONTOURS
Abrasive machining of major components
[AD-A071916] N80-12415

CONTROL BOARDS
Rational ways to increase pictographic symbol discriminability
N80-12734

CONTROL THEORY
Design and performance evaluation for systems in an uncertain environment
[AD-A073207] N80-12777

CONTROLLABILITY
Lifting surface divergence and control effectiveness
N80-12004

CONVERGENCE
Time marching methods for turbomachinery flow calculations: Methods of improving convergence — time dependence and convergence of flow equations in turbomachinery
N80-12370

CONVERGENT-DIVERGENT NOZZLES
Supersonic combustion, air dissociation through shock waves and aerodynamics of chemically reacting gases in a Planar converging - diverging nozzles — supersonic combustion ramjet engines
[AD-A073135] N80-12097

COORDINATES
Auto- and cross-correlation of image coordinates
N80-12456

COORDINATION
Scanner coordination problems: Images from over the sea
N80-12473

COPOLYMERS
Oscillatory flow birefringence measurements of block copolymers in solution
N80-12174

COPPER
Solderability — printed circuit boards and copper surfaces
[SAND-78-1749C] N80-12169
Experimental studies of laser induced detonation waves
N80-12214
Momentum density measurements in Cu and alpha-phase Cu-Zn alloys with a multi-counter two-dimensional angular correlation of annihilation radiation apparatus
N80-12913

COPPER ALLOYS
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165
Momentum density measurements in Cu and alpha-phase Cu-Zn alloys with a multi-counter two-dimensional angular correlation of annihilation radiation apparatus
N80-12913
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916

COPPER OXIDES
Effects of uniaxial stress on excitons in cuprous oxide
N80-12909

CORE SAMPLING
Geological assessment probe
[NASA-CASE-NPO-14558-1] N80-12642

CORNER FLOW
Flow field investigations in corner regions in hypersonic flow
N80-12040

CORRELATION COEFFICIENTS
Improved estimations under restricted parameters spaces
N80-12802

CORROSION
Materials compatibility in liquid sodium
[HEDL-SA-1559] N80-12147
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185

CORROSION PREVENTION
Evaluation of high chromium overplays to protect low alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163
Study of corrosion and its control in aluminum solar collectors
[COO-2934-7] N80-12609

CORROSION RESISTANCE
Application of sputtering to the improvement of coatings of superalloys
N80-12017
Evaluation of the use of corrosion inhibitors at the anodic oxide-metal interface
[AD-A073124] N80-12160

COSMIC GASES
Vertical structure of galactic gaseous disks
N80-12974

COSMIC RAYS
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
COSMOLOGY
Cosmological tests of a scale covariant theory of gravitation
N80-12976
COST ANALYSIS
Technology options for an enhanced air cargo system
[NASA-TM-80173] N80-12076
Validation of the Detroit Diesel Allison logistic support cost model [program OS 590]
[AD-A072670] N80-12094
Cost analysis of aquatic biomass systems
[BCP/ET/4000-76/1] N80-12302
Climate and economic activity
N80-12690
COST EFFECTIVENESS
Central Computational Facility CCF communications subsystem options
[NASA-CR-160181] N80-12257
COVARIANCE
Cosmological tests of a scale covariant theory of gravitation
N80-12976
CRACK INITIATION
A new method of electric measurement of crack length
N80-12018
A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436
The effect of pre-cracking on column behaviour
[PB-298743/6] N80-12439
CRACK PROPAGATION
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[ESA-TT-561] N80-12013
A new method of electric measurement of crack length
N80-12018
On the probability of crack propagation in a unidirectional composite with a single fiber breakage
[ESA-TT-524] N80-12125
Near-tip plastic deformations in dynamic fracture mechanics
[AD-A072833] N80-12443
CRACKING [FRACTURING]
Reinforcement to control thermal and shrinkage cracking
[PB-298412/8] N80-12237
Small-scale yielding at the tip of a through-crack in a shell
[AD-A072832] N80-12442
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
CRACKS
The effect of pre-cracking on column behaviour
[PB-298743/6] N80-12439
CREEP ANALYSIS
Recent concepts: Their influence on code predictions of shrinkage and creep — in concretes
[PB-298413/6] N80-12238
CRITERIA
Design and analysis of single cell balloons — stress analysis of high altitude balloons
[AD-A072828] N80-12048
CROP GROWTH
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field
[NASA-TM-80328] N80-12532
Global aspects of food production
N80-12680
CROP IDENTIFICATION
Classification of agricultural land with the aid of remote sensing methods
N80-12495
Aerial photography of agricultural farming land
N80-12496
Feasibility of using remote sensing for determining nutritional requirements, diseases and pst infestations in agricultural crops
N80-12497
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499
What are the advantages of multispectral classification? — for crop identification
N80-12501
A study of the tolerance block approach to special stratification — winter wheat in Kansas
[E80-10027] N80-12529
CROP INVENTORIES
Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry
N80-12500
A study of the tolerance block approach to special stratification — winter wheat in Kansas
[E80-10027] N80-12529
CROP VIGOR
Feasibility of using remote sensing for determining nutritional requirements, diseases and pst infestations in agricultural crops
N80-12497
CROSS CORRELATION
Auto- and cross-correlation of image coordinates
N80-12456
Texture analysis by means of synthetic impulse functions
N80-12466
CROSS FLOW
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
CROSS POLARIZATION
Cross polarization interference reduction techniques
[AD-A072760] N80-12266
CRUCIFORM WINGS
The normal force on a cruciform missile at bank angles of a deg and 45 deg
N80-12037
CRUDE OIL
Identification of a methodology for projecting short-term crude petroleum production in the United States
[DOE/EIA-0103/14] N80-12542
CRUISING FLIGHT
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818
Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819
CRYOGENIC WIND TUNNELS
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019
CRYOSTATS
Argonne program to assess superconducting stability
[CONF-781055-3] N80-12295
CRYSTAL DEFECTS
Single crystal defect studies by means of ion channeling
N80-12917
CRYSTAL LATTICES
Stored energy in the I sub b subscript of aluminum
N80-12154
Coherence studies in the first electronic excited singlet state of solid naphthalene
N80-12920
Theory of interstitial ordering in alloys with hexagonal close-packed crystal lattice
[IS-TRANS-106] N80-12937
High pressure studies of ionic conductivity in solids — high pressure study of ionic mobility and conductivity in crystal lattices
[SAND-79-1511C] N80-12943
CRYSTAL STRUCTURE
The crystal and molecular structure of trimethyltin chloride at 135 K, a highly volatile organotin polymer
[AD-A073641] N80-12180
Analysis of the structure deformation of sodium chloride submitted by a shock wave
N80-12212
The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907
CRYSTALLOGRAPHY
Crystallographic contributions to the energy problem
[CONF-780867-1] N80-12598
Intervalley transfer in n-type germanium at 77 deg K
N80-12928
CRYSTALS
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921
CUBIC LATTICES
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072766] N80-12936
CUMULATIVE DAMAGE
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
CUMULUS CLOUDS
Airborne measurements of cloud-forming nuclei and aerosol particles in stabilized ground clouds produced by solid rocket booster firings
[NASA-CR-160357] N80-12663
CURRENT DENSITY
Intervalley transfer in n-type germanium at 77 deg K
N80-12928
CURRENT DISTRIBUTION
Scattering of electromagnetic waves by obstacles in presence of the earth's surface current distribution on perfectly conducting cylindrical loops in an incident
[AD-A072893] N80-12273
CURVED PANELS
Postbuckling studies of curved laminated composite panels
N80-12434
CYANIDES
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135
CYCLIC HYDROCARBONS
Combined effects of polycyclic aromatic hydrocarbons and sunlight — on Chinese hamster V79 cells
[CONF-790447-4] N80-12631
CYCLOTRON RADIATION
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80568] N80-12989
CYCLOTRON RESONANCE
Miniature cyclotron resonance ion source using small permanent magnet
[NASA-CASE-NPO-14324-1] N80-12851
CYCLOTRON RESONANCE DEVICES
Miniature cyclotron resonance ion source using small permanent magnet
[NASA-CASE-NPO-14324-1] N80-12851
CYCLOTRONS
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80568] N80-12989
CYLINDRICAL BODIES
Curvature effects on the behavior of laminar boundary layers
N80-12045
CYLINDRICAL SHELLS
The dynamic response of elastic isotropic thin circular cylindrical shells to intense heat
N80-12426
CYTOLOGY
Human muscle fiber types in power lifters, distance runners and untrained subjects: A histochemical and ultrastructural study
N80-12727

D

D REGION
Two-body positive ion-negative neutralization
[AD-A073145] N80-12646
DATA ACQUISITION
Argonne program to assess superconducting stability
[CONF-781055-3] N80-12295
Contributions to fluid mechanics and ballistics — measuring instruments
[BMVG-FBWT-79-3] N80-12310
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314
Data acquisition and transmission from highly accelerated ballistic missiles of small and medium calibre — using miniaturized sensors and transmission systems
N80-12315
Data acquisition systems and data analysis in fluid dynamics
[VKI-LEC-SER-1979-5] N80-12354
Application of data acquisition systems for on-line definition and control of wind tunnel shape
N80-12356
Application of data acquisition system for on site measurements of wind effects on structures
N80-12357
Automatic data acquisition for digital height model
N80-12465
On the current state of remote sensing techniques
N80-12469
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
The 19304DT GSRS, missile no. 1031, round no. V-46
[AD-A073388] N80-12699
Recent automation changes in model velocity analyses and data acquisition by miniature price meters
[AD-A072692] N80-12751
Implications of an all-digital Navy technical information presentation system
[AD-A073095] N80-12951
DATA BASES
Energy information data base. Serial titles, February 1978 - March 1979
[DOE/TIC-4579-R10-SUPPL-4] N80-12601
Multiprocessor architectures for supporting secure database management
N80-12742
Atmosphere explorer MESA accelerometer density data base
[AD-A072851] N80-12749
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]
[AD-A072947] N80-12950

Mechanical intelligence: Research and applications
[AD-A073127] N80-12952
DATA LINKS
Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits
N80-12221
Tactical intelligence link control facility [TLCF] subsystem RF link remoting design and installation plans
[AD-A071789] N80-12263
DATA MANAGEMENT
Applications of the knowledge of climate
N80-12695
Multiprocessor architectures for supporting secure database management
N80-12742
Background storage management in operating systems for communications computers
[ESA-TT-500] N80-12755
DATA PROCESSING
Digital signal analysis: Theory and applications
N80-12355
On the current state of remote sensing techniques
N80-12469
Application of DIBIAS programs for improvements and geoscientific evaluations of LANDSAT photographs of central Morocco and Sudan
N80-12510
Recent automation changes in model velocity analyses and data acquisition by miniature price meters
[AD-A072692] N80-12751
Interactive use of computer drawn faces to study multidimensional data
[LA-7752-MS] N80-12774
DATA PROCESSING EQUIPMENT
Hemp study of planned DAS3 configuration
[AD-A072948] N80-12265
Automatic Data Processing Equipment [ADPE] acquisition plan for the medical sciences
[JSC-16075] N80-12746
DATA PROCESSING TERMINALS
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
DATA RECORDERS
Digital recording using hologram arrays: Developments of the transducers for an experimental 100Mbit/s recorder
[BBC-RD-1979/16] N80-12382
DATA REDUCTION
Central Computational Facility CCF communications subsystem options
[NASA-CR-160383] N80-12257
Interactive use of computer drawn faces to study multidimensional data
[LA-7752-MS] N80-12774
DATA SMOOTHING
Restitution of missile trajectories by Kalman filtering-smoothing
N80-12023
Application of a hierarchial classification method for special problems — correcting direction dependent variations in recorded signals
N80-12302
DATA STORAGE
Field electron and ion source research for high density information storage system
[AD-A073701] N80-12286
Evaluations in the framework of the FMP program using the digital image processing system DIDAK
N80-12507
Application of DIBIAS programs for improvements and geoscientific evaluations of LANDSAT photographs of central Morocco and Sudan
N80-12510
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
DATA SYSTEMS
Climate data
N80-12694
DATA TRANSMISSION
Design of instantaneously companded delta modulators with M-bit memory
N80-12232
Statistical methods for estimating time and rate parameters of digital communication
[PB-297977/1] N80-12277
Data acquisition and transmission from highly accelerated ballistic missiles of small and medium calibre — using miniaturized sensors and transmission systems
N80-12315
DAYTIME
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
DECISION MAKING
What role can simulation model predictions play in environmental decisions: Carbon dioxide as an example
[CONF-790468-1] N80-12632
DECOMPOSITION
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials — PETN and HNS in explosive components
[SAND-79-0935C] N80-12150
DEFENSE COMMUNICATIONS SATELLITE SYSTEM
Tactical intelligence link control facility [TLCF] subsystem RF link remoting design and installation plans
[AD-A071789] N80-12263
DEFORMATION
Analysis of the structure deformation of sodium chloride submitted by a shock wave
N80-12212
Large deflection analysis of portal frames
[PB-298741/0] N80-12248
Deformation mechanisms in the olivine and spinel phases of magnesium germanate and applications to the earth's mantle
N80-12631
DELAWARE RIVER BASIN [US]
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
DELTA MODULATION
Design of instantaneously companded delta modulators with M-bit memory
N80-12232
An adaptive delta modulator robust to transmission errors
N80-12234
DELTA WINGS
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
Aerodynamic characteristics of a hypersonic research airplane concept having a 70 deg sweptdouble-delta wing at Mach numbers from 0.80 to 1.20, with summary of data from 0.20 to 6.0 — Langley 8-ft transonic wind tunnel
[NASA-TP-1552] N80-12064
DENSE PLASMAS
Statistical mechanics of reacting dense plasmas
[UCRL-81936] N80-12903
DENSITY DISTRIBUTION
Information theory and the earth's density distribution
[NASA-TM-80586] N80-12643
DENSITY MEASUREMENT
Momentum density measurements in Cu and alpha-phase Cu-Zn alloys with a multi-counter two-dimensional angular correlation of annihilation radiation apparatus
N80-12913
DENTISTRY
Dental research: Preliminary observations and projections
N80-12392
Dosimetric considerations in dental applications
N80-12393
Maxillo: Facial diagnosis
N80-12394
DEPOLARIZATION
Effect of dimer dissociation on depolarized scattered light in dilute gases
N80-12864
DEPTH
Shallow bulk acoustic waves
[AD-A072742] N80-12825
DEPTH MEASUREMENT
A study in the determination of depth information from underwater acoustical scanners
N80-12458
DESCENT TRAJECTORIES
Effect of horizontal and vertical side forces and moments on stability of a symmetric missile in ascending or descending flight
[AD-A072808] N80-12067
DESERTS
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
DESIGN ANALYSIS
The performance of a conceptual vertical attitude takeoff and landing fighter aircraft
[AD-A073100] N80-12086
Satellite Power Systems [SPS] concept definition study. Volume 4: SPS point design definition
[NASA-CR-150683] N80-12106
The Lixiscope concept
N80-12385
DETONATION
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073058] N80-12146
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
Shock initiation and detonation models in one and two dimensions
[UCID-18024] N80-12194
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195
Contributions to ballistics, detonations, and pulse physics
[BMVG-FBWT-79-01] N80-12205
Detonation of nitromethane-Al-NO2 mixtures
N80-12206
Transient interactions of laser pulses with matter
N80-12213
DETONATION WAVES
Experimental studies of laser induced detonation waves
N80-12214
Applications of random-choice method to problems in shock and detonation-wave dynamics
[UTIAS-240] N80-12373
DEVELOPING NATIONS
A photovoltaic power system in the remote African village of Tangaye, Upper Volta
[NASA-TM-79316] N80-12552
DIATOMIC MOLECULES
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
DICHOTOMIES
Measuring inter-rater reliability of dichotomous responses: A components of variance approach
N80-12797
DIELECTRICS
Dielectric grating antennas
[AD-A073261] N80-12262
Numerical computation of electromagnetic scattering by inhomogenous penetrable bodies
[AD-A073143] N80-12268
Electron conductivity mobility in semiconductors based on a dielectric function modification of the Dingle impurity ion potential
N80-12922
DIFFERENCE EQUATIONS
On the existence of simple Liapunov Functions for linear retarded difference differential equations
[AD-A072762] N80-12784
DIFFERENTIAL EQUATIONS
On the existence of simple Liapunov Functions for linear retarded difference differential equations
[AD-A072762] N80-12786
Spline approximations for functional differential equations
[AD-A072763] N80-12785
DIFFERENTIAL GEOMETRY
System theory as applied differential geometry — linear system
[NASA-CR-3209] N80-12776
DIFFUSERS
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
DIFFUSION COEFFICIENT
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
DIFFUSION FLAMES
Rayleigh temperature profiles in a hydrogen diffusion flame
[SAND-78-8726] N80-12148
DIGITAL DATA
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314
DIGITAL FILTERS
Height interpolation by the method of finite elements
N80-12460
Covariance sequence approximation with applications to spectrum analysis and digital filter design
[AD-A072884] N80-12783
Uniform approximation by rational functions having restricted denominators
[AD-A072835] N80-12786
Burst processing — in performing arithmetic
[AD-A072872] N80-12807
DIGITAL SIMULATION
Real time digital model of a rolling airframe
[AD-A073456] N80-12075
Numerical solutions to problems in liquid membrane electrochemistry
N80-12136
Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits
N80-12221
DIGITAL SYSTEMS
F-111 A/E digital bomb-nav system software analysis
[AD-A072826] N80-12089
Advanced digital TV system
[AD-A072917] N80-12274
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314
Digital signal analysis: Theory and applications
N80-12355
Optical mass memory investigations. Volume 3: Considerations for the development of a DIGIMEM archival optical mass storage system
[NASA-CR-162460] N80-12745

Implications of an all-digital Navy technical information presentation system
[AD-A073095] N80-12951
DIGITAL TECHNIQUES
Flight flutter testing
N80-12912
Random harmonic analysis program, L221 (TEV156). Volume 1: Engineering and usage
[NASA-CR-2857] N80-12958
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
Digital processing procedure for texture analysis with remote sensing data
N80-12905
Correspondence problems in polygonal segmented multispectral digital images
N80-12908
Preliminary results on the use of digital methods with center of gravity data reduction in a pre-Alp test region
N80-12909
Notes from the Second Department of Energy Library Workshop
[UCRL-81736] N80-12984
Binary processing — in performing arithmetic
[AD-A072872] N80-12907
Turbulence measurements by digital spectral estimates in the chemically heated Protochoc Tornatron — digital techniques of signal processing to measure plasma turbulence
N80-12879
DIGITAL TRANSDUCERS
Digital recording using hologram arrays: Developments of the transducers for an experimental 100Mbit/s recorder
[BBC-RD-1979/16] N80-12382
DIMENSIONS
Some contemplated improvements to the prototype Linicope
N80-12389
DIMERS
Effect of dimer dissociation on depolarized scattered light in dilute gases
N80-12864
DIPOLE ANTENNAS
Mutual coupling effects on a circular array of dipoles
[AD-A073077] N80-12267
DIPOLE MOMENTS
Microwave spectra and theoretical calculation of transient molecules — determining the ground state and dipole moment
N80-12838
DIRECTIONAL ANTENNAS
Dielectric grating antenna
[AD-A073261] N80-12262
DIRECTIVITY
Directional distributions of beta-rays emitted from oriented nuclei
N80-12849
DISCRETE ADDRESS BEACON SYSTEM
DABS single sensor performance test plan
[AD-A072695] N80-12080
DISEASES
Climate, health and disease
N80-12679
DISKS [SHAPES]
Viscoelastic radial flow between parallel disks
N80-12309
DISPLACEMENT MEASUREMENT
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730
DISPLAY DEVICES
X-ray source characteristics and detection efficiencies of prototype Linicopes
N80-12388
Helicopter canopy internal reflection investigation
[AD-A072086] N80-12867
DISSOLVING
Electroless [chemisphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141
DIURNAL VARIATIONS
Summer weather on Haleakala, Maui
[UHMET-79-09] N80-12708
DOMESTIC ENERGY
The great adventure: A report on the 10 regional public hearings on solar energy for the domestic policy review
[HCP/U6354-01] N80-12567
DOPPLER RADAR
The development of passive Doppler techniques in LRSL/ISL and their applications to ballistic and aerodynamic measurements
N80-12210
DRILLING
Naturally occurring carbon dioxide sources in the United States. A geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery
[FE-2025-36] N80-12624
DROPS [LIQUIDS]
Investigation of critical burning of fuel droplets
[NASA-CR-159697] N80-12142
Spreading kinetics of a liquid drop on a solid surface
N80-12307
DUCT GEOMETRY
Reciprocity principle in duct acoustics
[NASA-TM-79308] N80-12824
DUCTED FLOW
Analysis of the separation due to shock wave-turbulent boundary layer interaction in transonic flow
N80-12031
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
Heat transfer in a column packed with spheres
N80-12343
DUCTILITY
Ductility minimum and its reversal with aging in carbon-base superalloys
[ORNL/TM-6624] N80-12170
DURABILITY
Durability of concrete bridge decks
[PB-298829/3] N80-12347
DYE LASERS
Intracavity quenching and dye kinetics of a nitrogen laser pumped dye laser
N80-12403
DYNAMIC CHARACTERISTICS
The physical basis of climate
N80-12671
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162508] N80-12979
DYNAMIC LOADS
A program for calculating load coefficient matrices utilizing the force summation method, L218 (LOADS). Volume 1: Engineering and usage
[NASA-CR-2853] N80-12056
Near-tip plastic deformations in dynamic fracture mechanics
[AD-A072833] N80-12443
DYNAMIC RESPONSE
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation — surface navigation
[AD-A073153] N80-12081
The effects of frustrum turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239
Analytical procedures in soil dynamics
[PB-298445/1] N80-12243
The dynamic response of elastic isotropic thin circular cylindrical shells to intense heat
N80-12426
Postbuckling studies of curved laminated composite panels
N80-12434
Linear and nonlinear earthquake responses of simple torsionally coupled systems
[PB-298262/7] N80-12450

E

EARTH [PLANET]
Information theory and the earth's density distribution
[NASA-TM-80586] N80-12643
EARTH ATMOSPHERE
Climates of past geological epochs — paleogeography
N80-12670
The physical basis of climate
N80-12671
Modeling of climatic changes and the problem of long-range weather forecasting
N80-12672
EARTH CRUST
Geological assessment code
[NASA-CASE-NPO-14558-1] N80-12642
Analysis of measured values for the state of stress in the earth's crust
[LBL-7071] N80-12648
Structure of the earth's crust and upper mantle plotted from data of seismic studies
[UCRL-TRANS-11392] N80-12650
EARTH HYDROSPHERE
Remote Sensing and Problems of the Hydrosphere
[NASA-CP-2109] N80-12718
EARTH MANTLE
Deformation mechanisms in the olivine and spinel phases of magnesium germanate and applications to the earth's mantle
N80-12638
A global geochemical model for the evolution of the mantle
[NASA-CR-162602] N80-12644
EARTH RESOURCES
Global aspects of food production
N80-12680
Data requirements for oceanic processes in the open ocean, coastal zone, and cryosphere
[NASA-CR-162451] N80-12719
EARTHQUAKE RESISTANT STRUCTURES
A mathematical model of masonry for predicting its linear seismic response characteristics
[PB-298266/8] N80-12241
Hysteretic behavior of lightweight reinforced concrete beam-column subassemblages
[PB-298267/6] N80-12451
EARTHQUAKES
Seismic vulnerability, behavior and design of buried pipelines, phase I
[PB-298269/2] N80-12240
Analytical procedures in soil dynamics
[PB-298445/1] N80-12243
Inelastic behavior of steel structures subjected to earthquake-induced ground motion
N80-12431
Linear and nonlinear earthquake responses of simple torsionally coupled systems
[PB-298262/7] N80-12450
ECOLOGY
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
Guiding the development of a controlled ecological life support system
[NASA-CR-162452] N80-12735
Evaluation of a ground based manned demonstration as a milestone in CELSS development
N80-12736
Development requirements for a successful ground based CELSS demonstration
N80-12737
ECONOMIC ANALYSIS
Efforts on the economic analysis of Darrieus vertical axis wind turbines
[SAND-78-1851/C] N80-12579
Economics of fusion driven symbiotic energy systems
[CONF-790602-30] N80-12602
Technical and economic assessment of solar powered water pumping for remote areas
[SAND-79-8187] N80-12608
ECONOMIC DEVELOPMENT
Houston Conference on the Revitalization of the Inner City
[PB-298906/9] N80-12965
ECONOMIC IMPACT
Regional economic/demographic projections for energy policy analysis
[ORNL/TM-6668] N80-12599
Climate at the millennium
N80-12666
Climate and economic activity
N80-12690
ECOSYSTEMS
Global ecology and man
N80-12668
EDDY CURRENTS
Transient 3-d eddy current in multiple conductors
[CONF-790730-2] N80-12298
EDDY VISCOSITY
Second order modeling of turbulent flows
N80-12318
EDUCATION
Energy conservation technology education program
[HCP/M2165] N80-12606
EIGENVALUES
Eigenvalue bounds and stability of conservative fluid and plasma flows
N80-12875
ELASTIC BUCKLING
Buckling and post-buckling behavior of elasto-plastic structures
N80-12430
ELASTIC PROPERTIES
Inelastic behavior of steel structures subjected to earthquake-induced ground motion
N80-12431
ELASTIC SCATTERING
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
ELASTOMERS
The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177
ELASTOPLASTICITY
On some new general and complementary energy theorems for the rate problems in finite strain, classical elasto-plasticity
[AD-A072969] N80-12444
ELECTRIC AUTOMOBILES
Mechanical energy storage technology development for electric and hybrid vehicle applications
[UCRL-81786] N80-12596
ELECTRIC BATTERIES
Investigations of the safety of Li/SOCl sub 2 batteries
[AD-A072862] N80-12555
ELECTRIC CHARGE
Study program for constant current capacitor charging method
[UCRL-13914] N80-12297
ELECTRIC CONDUCTORS
A new method of electric measurement of crack length
N80-12018

Transient 3-d eddy current in multiple conductors
[CONF-790720-2] N80-12298

ELECTRIC FIELDS
Intervalley transfer in n-type germanium at 77 deg K
N80-12928
Micropulsations in the electric field near the plasmapause, observed by ISEE-1
[NASA-TM-80580] N80-12986

ELECTRIC GENERATORS
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-155-010] N80-12291

ELECTRIC HYBRID VEHICLES
Mechanical energy storage technology development for electric and hybrid vehicle applications
[UCRL-81786] N80-12586

ELECTRIC MOTOR VEHICLES
The USAF Academy flywheel-electric car preliminary design report
[AD-A071242] N80-12553
Demand for special performance vehicles, 1975 - 2025
[UCRL-13911] N80-12960

ELECTRIC POWER PLANTS
Effect of operating temperatures on the cost of energy from solar thermal electric power plants
[SAND-79-0801] N80-12563
Project CESA-1, a 1 MW solar power plant in Almeria
[AED-CONF-78-212-011] N80-12614

ELECTRIC SPARKS
Fanning of spark discharges
N80-12215

ELECTRICAL FAULTS
Electrical overstress program
[AD-A073148] N80-12422

ELECTRICAL MEASUREMENT
A new method of electric measurement of crack length
N80-12018
Measurement techniques for high-power semiconductor materials and devices: — application to energy technologies
[PB-298574/5] N80-12300

ELECTRICAL PROPERTIES
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TF] N80-12891
Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927

ELECTRICAL RESISTIVITY
Transport theory of carriers across semiconductor heterojunction interfaces
N80-12280
Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923

ELECTRICITY
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580
A regional approach to forecasting electric energy requirements for environmental assessments
N80-12619

ELECTRO-OPTICS
Minicomputer applications in automated testing of electro-optical guidance systems
[AD-A073092] N80-12407
Optical mass memory investigations. Volume 3: Considerations for the development of a DIGIMEM archival optical mass storage system
[NASA-CR-162460] N80-12745

ELECTROCARDIOGRAPHY
Statistical representation of electrocardiographic body surface maps for feature identification data compression and classification
N80-12728

ELECTROCHEMISTRY
Numerical solutions to problems in liquid membrane electrochemistry
N80-12136
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
On the properties of a fuel cell electrolyte
[AD-A072864] N80-12554
Investigations of the safety of Li/SOCl sub 2 batteries
[AD-A072862] N80-12555

ELECTRODYNAMICS
User's manual for the magnetohydrodynamic generator channel code, MHDCHN
[SAND-78-1260] N80-12894

ELECTROFORMING
Weldability of electroformed nickel
[Y-2171] N80-12172

ELECTROLYTES
On the properties of a fuel cell electrolyte
[AD-A072864] N80-12554

ELECTROMAGNETIC FIELDS
Gravitational and electromagnetic potentials of the stationary Einstein-Maxwell field equations
N80-12641

ELECTROMAGNETIC INTERACTIONS
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
Research program in elementary particle theory — study of particle theory in astrophysics, electromagnetic interactions, and quantum theory
[ORO-3992-362] N80-12842
Photofission and electrofission
[UCRL-81596] N80-12942

ELECTROMAGNETIC INTERFERENCE
Electromagnetic interference (EMI) radiative measurements for automotive applications
[PB-298605/7] N80-12276
Proceedings of the 1978 Electromagnetic Interference Workshop
[PB-298675/0] N80-12279

ELECTROMAGNETIC PULSES
Hemp study of planned DAS3 configuration
[AD-A072946] N80-12265
The infinite parallel-wire array over a ground plane: A code for an EMP vulnerability assessment and hardening program
[AD-A073103] N80-12770

ELECTROMAGNETIC RADIATION
Helicopter canopy internal reflection investigation
[AD-A073084] N80-12867

ELECTROMAGNETIC SCATTERING
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
[AD-A073143] N80-12268
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 2: Numerical evaluation
[AD-A072998] N80-12269
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 1: Theory
[AD-A072984] N80-12270
A rigorous theory for plane wave scattering from periodic trapezoidal metal surfaces
[AD-A072983] N80-12271
Scattering of electromagnetic waves by obstacles in presence of the earth's surface current distribution on perfectly conducting cylindrical loops in an incident
[AD-A072880] N80-12273

ELECTROMAGNETIC SHIELDING
Hemp study of planned DAS3 configuration
[AD-A072946] N80-12265
The infinite parallel-wire array over a ground plane: A code for an EMP vulnerability assessment and hardening program
[AD-A073103] N80-12770

ELECTRON BEAMS
Heated electron beam cell study
[AD-A072875] N80-12410

ELECTRON ENERGY
Experimental study of low-energy charge transfer in nitrogen
[NASA-TM-80156] N80-12398

ELECTRON IMPACT
Electron-impact excitation of n = 2 levels of helium at intermediate energies
[ORO-4881-24] N80-12846

ELECTRON MOBILITY
Turbulent destabilization and saturation of the universal drift mode in a sheared magnetic field — electron mobility in turbulent diffusion in a magnetic field
[ORNL/TM-4620] N80-12815
Electron conductivity mobility in semiconductors based on a dielectric function modification of the Dingle impurity ion potential
N80-12932

ELECTRON ORBITALS
Electron correlation and Hund's rule — study of electron states, atomic structure, and electron orbitals
N80-12830

ELECTRON SCATTERING
Studies of electron correlation in the photoionization process
[LBL-8948] N80-12945

ELECTRON STATES
Electron correlation and Hund's rule — study of electron states, atomic structure, and electron orbitals
N80-12830
Electron-impact excitation of n = 2 levels of helium at intermediate energies
[ORO-4881-24] N80-12846
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80588] N80-12989

ELECTRONIC EQUIPMENT TESTS
Investigation of moisture measurements, failure rate and leak rate and a study of moisture infusion
[PB-299172/7] N80-12299

ELECTRONS
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984

ELECTROPLATING
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing
[PB-298841/8] N80-12173
Feasibility of electroplated gold for hybrid microcircuits
[BDX-613-2114] N80-12290

ELECTROSTATIC CHARGE
Specification of the natural plasma environment at geosynchronous orbit
[AD-A073160] N80-12883

ELECTROSTATIC WAVES
Intense electrostatic waves near the upper hybrid resonance frequency
N80-12640

ELECTROSTATICS
Electrostatics, small particles, and laser fusion targets
[UCRL-81537] N80-12834

ELEVATION
Automatic data acquisition for digital height model
N80-12446

ELEVATION ANGLE
Some considerations about sky noise temperature at frequencies above 10GHz
N80-12229

ELLIPSOIDS
Analysis and synthesis of an elliptical paraboloid offset reflector antenna. An elliptically shaped beam antenna
N80-12225
Analytical and graphical methods for the design of an elliptically shaped beam antenna with elliptical parabeloid reflector
N80-12226
An elliptically shaped beam antenna
N80-12227

ELLIPSOMETERS
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157

ELLIPTIC DIFFERENTIAL EQUATIONS
High-order accurate solution of Laplace's equation on general regions using integral equation methods and fast Poisson solvers
N80-12781
Block relaxation techniques for finite-element elliptic equations: An example
[LA-7870-MS] N80-12794

EMBRITTLEMENT
Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation
[TFBP-TR-292] N80-12364

EMERGENCIES
Control of ELT false alarms
[NASA-CR-162902] N80-12255
Standby conservation plan no. 2: Emergency building temperature restrictions. Authorities: Need, rationale, operation
[DOE/ERA-0048] N80-12582

EMISSION SPECTRA
X-ray emission in heavy-ion collision
[ORO-4036-1] N80-12843
On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973

END PLATES
Development of the substructural element method for stress analysis
N80-12433

ENERGY BUDGETS
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527

ENERGY CONSERVATION
Air-to-air heat exchangers: Saving energy and improving indoor air quality
[LBL-7981] N80-12380
Inventory of advanced energy technologies and energy conservation research and development, 1976-1978, volume 1
[GPO-41-481] N80-12530
Standby conservation plan no. 2: Emergency building temperature restrictions. Authorities: Need, rationale, operation
[DOE/ERA-0048] N80-12582
Constraints on energy conservation
[ORAU/IEA-78-17[M]] N80-12594
Fundamental aspects of energy conservation policy
[ORAU/IEA-78-20[M]] N80-12595
Energy conservation technology education program
[HCP/M2165] N80-12606
National Energy Act of 1978: A regional assessment
[PB-296479/9] N80-12615
Transportation and the future
[PB-298907/7] N80-12964

ENERGY CONSUMPTION
Constraints on energy conservation
[ORAU/IEA-78-17[M]] N80-12594
Fundamental aspects of energy conservation policy
[ORAU/IEA-78-20[M]] N80-12595

ENERGY CONVERSION
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Mass spectrometry and fossil-energy conversion technology: A review
[FE-2537-7] N80-12198
Photoelectrochemical conversion of optical energy to electricity and fuels
[AD-A072861] N80-12556
Commercial application of molten carbonate fuel cell system
[CONF-790213-4] N80-12557

ENERGY CONVERSION EFFICIENCY
Comparison of geothermal energy with coal, oil, and natural gas for selected uses
[DOE/ET-27139-1] N80-12558
Systems Analysis and testing [SAT] program
[SERI/PR-35-313] N80-12565
ENERGY LEVELS
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-79-XX-95] N80-12950
ENERGY POLICY
The future role of hydrogen fuel in an electrical society
[UTIAS-241] N80-12189
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1020] N80-12192
Economical aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12201
Shale oil: US and world resources and prospects for near-term commercialization in the United States
[ORAU/IEA-79-8[R]] N80-12544
Foam solar sea power: A physical investigation
N80-12548
Effect of operating temperatures on the cost of energy from solar thermal electric power plants
[SAND-79-0891] N80-12563
Optimization of photovoltaic/thermal collector heat pump systems
[COO-4577-7] N80-12566
The great adventure: A report on the 10 regional public hearings on solar energy for the domestic policy review
[MCP/U6354-01] N80-12567
Low-temperature thermal energy storage program annual operating plan
[ORNL/TM-6605] N80-12568
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580
Standby conservation plan no. 2: Emergency building temperature restrictions. Authorities: Need, rationale, operation
[DOE/ERA-0048] N80-12582
United States magnetic fusion energy program
[DOE/ET-0072] N80-12583
October 1978 environmental data for sites in the National Solar Data Network
[SOLAR/0010-78-10] N80-12585
Residential on site solar heating systems. A project evaluation using the capital asset pricing model
[LBL-8298] N80-12588
Analysis of the California solar resource, volume 2
[LBL-7060-VOL-2] N80-12589
Constraints on energy conservation
[ORAU/IEA-78-17[M]] N80-12594
Fundamental aspects of energy conservation policy
[ORAU/IEA-78-20[M]] N80-12595
Regional economic/demographic projections for energy policy analysis
[ORNL/TM-6660] N80-12599
Solar Heating And Cooling Of Buildings [SHACOB] Commercialization report. Part B: Analysis of market development, volume 2
[DOE/TIC-10071] N80-12603
Effects of energy policy on industry
[USFFE-1978-8] N80-12604
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605
Energy conservation technology education program
[HCP/M2165] N80-12606
Research and development of a heat and pump water heater, volume 1
[ORNL/SUB-7321-1] N80-12613
National Energy Act of 1978: A regional assessment
[PB-296679/9] N80-12615
Environmental aspects of alternative energy technologies for California
[UCRL-15002] N80-12628
Energy and climate: A review with emphasis on global interactions
N80-12677
National energy act of 1978: Far western perspective. A study for the US Department of Energy, Federal Region 9
[UCID-17944-REV-1] N80-12955
ENERGY REQUIREMENTS
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580
Constraints on energy conservation
[ORAU/IEA-78-17[M]] N80-12594
A regional approach to forecasting electric energy requirements for environmental assessments
N80-12619
ENERGY SOURCES
Cost analysis of aquatic biomass systems
[HCP/ET/4000-78/1] N80-12202
ENERGY STORAGE
Application of packed beds to energy storage use of latent heat of fusion
N80-12353
Anion permselective membrane
[NASA-CR-159599] N80-12551
The USAF Academy flywheel-electric car preliminary design report
[AD-A071242] N80-12553
Batteries for specific solar applications
[SAND-79-1428C] N80-12559
Solar mechanical energy storage project
[SAND-78-1982C] N80-12590
Mechanical energy storage technology development for electric and hybrid vehicle applications
[UCRL-81786] N80-12596
Research on the dynamics of hand-supported flywheel systems
[SAND-78-7074] N80-12597
ENERGY TECHNOLOGY
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2247-2] N80-12191
Status of the PEATGAS process
[CONF-781045-3] N80-12199
Measurement techniques for high-power semiconductor materials and devices: — application to energy technologies
[PB-298574/5] N80-12300
Automated longwall guidance and control systems, phase 1
[NASA-CR-161329] N80-12538
Automated longwall guidance and control systems, phase 2, part 2: Vertical control system [VCS]
[NASA-CR-161330] N80-12539
Automated longwall guidance and control systems, phase 2, part 2: RCS, FAS, and MCS
[NASA-CR-161331] N80-12540
Overview of in situ oil shale technology and recent advances in true in situ retort modeling
[SAND-78-2367C] N80-12543
Inventory of advanced energy technologies and energy conservation research and development, 1976-1978, volume 1
[GPO-41-481] N80-12550
The USAF Academy flywheel-electric car preliminary design report
[AD-A071242] N80-12553
Batteries for specific solar applications
[SAND-79-1428C] N80-12559
Thermoelectric ocean thermal energy conversion
[SERI/TP-35-254] N80-12564
Systems Analysis and testing [SAT] program
[SERI/PR-35-313] N80-12565
Low-temperature thermal energy storage program annual operating plan
[ORNL/TM-6605] N80-12568
Evaluation of solar Rankine-cycle engine systems
[SAND-78-0986] N80-12571
Direct labor requirements for select solar energy technologies: A review and synthesis
[SERI/RR-53-045] N80-12578
United States magnetic fusion energy program
[DOE/ET-0072] N80-12583
Experimental test facility for evacuation of solar control strategies
[LBL-8308] N80-12586
Analysis of the California solar resource, volume 2
[LBL-7060-VOL-2] N80-12589
Solar mechanical energy storage project
[SAND-78-1982C] N80-12590
Crystallographic contributions to the energy problem
[CONF-780867-1] N80-12598
Energy information data base. Serial titles, February 1976 - March 1979
[DOE/TIC-4579-R10-SUPPL-4] N80-12601
Energy conservation technology education program
[HCP/M2165] N80-12606
Research and development of a heat and pump water heater, volume 1
[ORNL/SUB-7321-1] N80-12613
Environmental aspects of alternative energy technologies for California
[UCRL-15002] N80-12628
Wind resource analysis
[SERI/TR-36-088] N80-12710
Search for fusion power
[UCRL-81990] N80-12900
Demand for special performance vehicles, 1975 - 2025
[UCRL-13911] N80-12960
ENERGY TRANSFER
Description of nonlinear internal wave interactions using Langevin methods
[AD-A069010] N80-12721
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12880
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919
ENGINE DESIGN
Design, durability and low cost processing technology for composite fan exit guide vanes
[NASA-CR-159677] N80-12091
Evaluation of solar Rankine-cycle engine systems
[SAND-78-0986] N80-12571
Closed-cycle hydride engines
[SAND-78-2228] N80-12572
ENGINE PARTS
Engine component improvement program: Performance improvement — fuel consumption
[NASA-TM-79304] N80-12092
ENGLAND
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Gwendon Underwood and Newbury, England
[E80-10022] N80-12525
ENTROPY
Stored energy in the I sub b subrange of aluminum
N80-12154
ENVIRONMENT EFFECTS
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing
[PB-298841/8] N80-12173
Environmental aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12201
Comparison of geothermal energy with coal, oil, and natural gas for selected uses
[DOE/ET-27139-1] N80-12558
Environmental aspects of alternative energy technologies for California
[UCRL-15002] N80-12628
Assessing man's impact on wetlands
[PB-298734/0] N80-12634
Climatic change and human strategy
N80-12667
Global ecology and man
N80-12668
Energy and climate: A review with emphasis on global interactions
N80-12677
Report on discussions held during the first week of the conference — world climate conference, Geneva, Jan. 1978
N80-12692
The influence of society on climate change and variability
N80-12696
ENVIRONMENT MANAGEMENT
The first five years of coastal zone management
[PB-298780/7] N80-12723
ENVIRONMENT MODELS
What role can simulation model predictions play in environmental decisions: Carbon dioxide as an example
[CONF-790468-1] N80-12632
ENVIRONMENT SIMULATION
Dynamic behavior of single and multiple vortex tornadoes inferred from laboratory simulation
N80-12657
ENVIRONMENTAL CONTROL
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12660
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
Climatic change and human strategy
N80-12667
ENVIRONMENTAL ENGINEERING
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629
ENVIRONMENTAL MONITORING
Climate data
N80-12694
EPITAXY
The measurement of temperature instabilities and their effect on the liquid phase epitaxial growth of gallium arsenide
[ERL-0077-TR] N80-12931
EQUATIONS OF MOTION
Modal analysis of aircraft structures
N80-12003
Unsteady aerodynamic inputs for aeroelastic analyses: A general introduction
N80-12008
Aircraft flutter and dynamic response
N80-12010
Equation modifying program, L219 [EQMOD]. Volume 1: Engineering and usage
[NASA-CR-2855] N80-12057
Improvements to the solution of the viscous shock layer equations
[AD-A072673] N80-12071
Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12814
EQUIPMENT SPECIFICATIONS
Automatic Data Processing Equipment [ADPE] acquisition plan for the medical sciences
[JSC-16075] N80-12746

Large mass storage facility — for computers
[BNL-50900] N80-12753
ERROR ANALYSIS
On the solution of a certain linear least squares fit problem
[AD-A072689] N80-12792
Direct and inverse error estimates for finite elements with mesh refinements
[ORO-3443-81] N80-12793
ERROR CORRECTING CODES
Application of a hierarchial classification method for special problems — correcting direction dependent variations in recorded signals
N80-12502
Interactive correction of classified photographs
N80-12503
Error correction coding with NMIS microprocessors. Volume 1: Concepts
[AD-A072982] N80-12747
Error correction coding with NMOS microprocessors. Volume 2: A 6800-based 7, 3 Reed-Solomon Decoder
[AD-A073088] N80-12748
ERROR CORRECTING DEVICES
An adaptive quantizer with channel error recovery
N80-12231
An adaptive delta modulator robust to transmission errors
N80-12234
ERROR DETECTION CODES
Progress in photogrammetric point determination by compensation of systematic errors and detection of gross errors
N80-12462
ERRORS
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740
ESTIMATES
A conditional property of adaptive estimators — Monte Carlo method
[AD-A072991] N80-12790
ESTUARIES
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
EUCLIDEAN GEOMETRY
Finite group actions on simply-connected manifolds and CW complexes
N80-12778
EULER EQUATIONS OF MOTION
Computation of water waves
[AD-A072944] N80-12375
EUROPE
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
EUTECTIC ALLOYS
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
EVAPORATION
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-155-010] N80-12291
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
EVAPOTRANSPIRATION
An evapo-transmission method for determining relative permeability of concrete
[PB-298323/7] N80-12251
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
EVEN-EVEN NUCLEI
Hydrodynamic model wavefunctions in intrinsic coordinates and their application to the structure of even-even nuclei
[IS-T-825] N80-12847
EXCIMERS
Synthesis and photophysical properties of a fluorescent polyamide series and their monomer analogs: Novel intramolecular excimer and exciplex interactions
N80-12175
EXCITATION
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
EXCITONS
Effects of uniaxial stress on excitons in cuprous oxide
N80-12909
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919
Coherence studies in the first electronic excited singlet state of solid naphthalene
N80-12920
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921
EXHAUST GASES
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — langley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
Approaches to level 2 analysis based on level 1 results, MEG categories and compounds, and decision criteria — air pollution monitoring
[EPA-600/7-79-063A] N80-12153
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620
EXHAUST NOZZLES
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — langley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
EXPERIMENTAL DESIGN
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
Experimental verification of a combined environment accelerated aging method applied to electrical cable material
[SAND-78-1907A] N80-12424
Development and application of methods of experimental mechanics — photoelastic and viscoelastic stress analysis
[AD-A072836] N80-12441
EXPLORER 55 SATELLITE
Atmosphere explorer MESA accelerometer density data base
[AD-A072851] N80-12749
EXPLOSIONS
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073058] N80-12146
EXPLOSIVES
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073058] N80-12146
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190
Shock initiation and detonation models in one and two dimensions
[UCID-18024] N80-12194
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195
Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12814
EXPONENTIAL FUNCTIONS
Effects of categorization on relationships in bivariate distributions and applications to rating scales
N80-12796
A special distribution result for bilinear forms
[AD-A072933] N80-12808
EXTERNAL STORES
Prediction of drag coefficients of a supersonic V/STOL configuration with various store arrangements
[AD-A072999] N80-12085

F

F-111 AIRCRAFT
F-111 A/E digital bomb-nav system software analysis
[AD-A072826] N80-12089
FABRICS
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179
FAILURE ANALYSIS
On the probability of crack propagation in a unidirectional composite with a single fiber breakage
[ESA-TT-524] N80-12125
Failure and repair of continuously reinforced concrete pavement
[PB-298832/7] N80-12246
Performance of buried flexible conduits — highways
[PB-298224/7] N80-12250
FARMLANDS
Classification of agricultural land with the aid of remote sensing methods
N80-12495
Aerial photography of agricultural farming land
N80-12496
What are the advantages of multispectral classification? — for crop identification
N80-12501
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
FEASIBILITY ANALYSIS
Engine component improvement program: Performance improvement — fuel consumption
[NASA-TM-79304] N80-12092
FEEDBACK CONTROL
Modular theory of inverse systems
[NASA-CR-162491] N80-12782
FEET [ANATOMY]
Podiatry
N80-12396
FERRITIC STAINLESS STEELS
Austenitic stainless steel-to-ferritic steel transition joint welding for elevated temperature service
[CONF-781068-1] N80-12417
FERTILIZERS
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
FIBER COMPOSITES
Second generation PMR polyimide/fiber composites
[NASA-CR-159666] N80-12118
Mechanical property characterization of intraply hybrid composites
[NASA-TM-79306] N80-12120
Fracture behavior and analysis of fiber reinforced concrete beams
[PB-297743/7] N80-13453
FIBER OPTICS
Lifetime prediction for optical glass fibers
[AD-A072771] N80-12872
FIBERS
Human muscle fiber types in power lifters, distance runners and untrained subjects: A histochemical and ultrastructural study
N80-12727
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
FIELD EFFECT TRANSISTORS
Method of making V-MOS field effect transistors
[NASA-CASE-GSC-12515-1] N80-12281
Gallium arsenide vertical channel insulated gate field effect transistor
[AD-A071706] N80-12285
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294
FIELD EMISSION
Field electron and ion source research for high density information storage system
[AD-A073701] N80-12286
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
FIELD THEORY [PHYSICS]
An NMR study of the critical phenomena of MnF2 in a 75 KG field
N80-12929
FIGHTER AIRCRAFT
The performance of a conceptual vertical attitude takeoff and landing fighter aircraft
[AD-A073100] N80-12086
FILE MAINTENANCE [COMPUTERS]
IMS 11: An Information on Management System for the PDP 11 computer
[PB-298731/1] N80-12756
FILM COOLING
Computation of discrete hole film cooling flow using the Navier-Stokes equations — gas turbine blades
[AD-A073057] N80-12096
FILTRATION
Preparation and characterization of latexes
N80-12115
FINANCIAL MANAGEMENT
Development of a joint-cost-allocation manual for Integrated Community Energy Systems [ICES]
[ANL/ICES-TM-20] N80-12581
FINITE DIFFERENCE THEORY
Unsteady aerodynamic inputs for aeroelastic analysis: A general introduction
N80-12008
A computational method for calculating laminar-turbulent transition in a boundary layer
N80-12047
Two-dimensional mesh adjustment algorithm
[AD-A073060] N80-12787
Time-dependent difference theory for noise propagation in a two-dimensional duct — of a turbofan engine
[NASA-TM-79298] N80-12822

A time dependent difference theory for sound propagation in ducts with flow — characteristic of inlet and exhaust ducts of turbofan engines
[NASA-TM-79302] N80-12023
FINITE ELEMENT METHOD
Practical aspects of the calculation of structural vibrations
N80-12007
Unsteady aerodynamic inputs for aeroelastic analysis: A general introduction
N80-12008
Finite element calculations of turbomachinery flows — analysis of finite element method and flow equations in the fluid mechanics of turbomachinery
N80-12367
Buckling and post-buckling behavior of elasto-plastic structures
N80-12430
A penalty function approach for the nonlinear finite element analysis of thin shells
N80-12432
Postbuckling studies of curved laminated composite panels
N80-12434
The method of weighted residuals in the time domain applied to nonlinear vibrations
[NAL-TR-564T] N80-12435
A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436
On some new general and complementary energy theorems for the rate problems in finite strain, classical elasto-plasticity
[AD-A072969] N80-12444
Rate complementary energy principles finite strain plasticity problems and finite elements
[AD-A072970] N80-12446
OASIS: A general purpose mesh generator for finite element codes
[M-301] N80-12449
Height interpolation by the method of finite elements
N80-12480
Inversion of isoparametric mappings and applications of computer graphics to three dimensional finite element analysis
[AD-A073013] N80-12791
Direct and inverse error estimates for finite elements with mesh refinements
[ORO-3443-81] N80-12793
Block relaxation techniques for finite-element elliptic equations: An example
[LA-7870-MS] N80-12794
FIRE EXTINGUISHERS
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190
FIRE PREVENTION
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079
Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143
FIREBREAKS
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079
FISHES
Climatic variation and marine fisheries
N80-12688
FLAME PROPAGATION
Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143
Flame - a slow-flow combustion model
[AD-A072988] N80-12145
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
Models of turbulent combustion for numerical predictions
N80-12324
FLAME STABILITY
Promising quality and flame stability: A theoretical and experimental study
[NASA-CR-3216] N80-12090
FLAT PLATES
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefield hypersonic flow
N80-12050
FLEXING
Inelastic behavior of steel structures subjected to earthquake-induced ground motion
N80-12431
FLIGHT CONTROL
Validation Methods for Fault-Tolerant avionics and control systems, working group meeting 1
[NASA-CP-2114] N80-12741
FLIGHT CREWS
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733
FLIGHT PATHS
Scanner coordination problems: Images from over the sea
N80-12473
FLIGHT SAFETY
Aviation Safety and Noise Abatement Act of 1979
[S-REPT-96-52] N80-12421
FLIGHT SIMULATION
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-12036
V/STOL flight simulation
[NASA-TM-81156] N80-12100
Determination in ground facilities of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12102
FLIGHT TESTS
Flight flutter testing
N80-12012
Synthesis of flight results of the Cactus accelerometer for accelerations below one billionth G
N80-12033
FLOOD DAMAGE
Climate and society: Lessons from recent events
N80-12691
FLOQUET THEOREM
Scattering from periodic surfaces with sinusoidal height profile: A theoretical approach. Part 1: Theory
[AD-A072964] N80-12270
FLORIDA
Position paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12662
FLOW DEFLECTION
Calculation - experiment comparisons of the transonic two-dimensional flow in a high-deflection cascade
N80-12016
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350
Hot spot phenomena in active packed beds
N80-12351
FLOW DISTORTION
Temperature distortion — in a compressor inflow
N80-12332
Unsteady pressure distortion — in compressor inflow
N80-12333
FLOW DISTRIBUTION
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Analysis and modelling of the flow within a turbomachine combustor
N80-12024
Experimental investigation of large scale structures in turbulent jet mixing layers
N80-12027
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-intakes
N80-12038
Flow field investigations in corner regions in hypersonic flow
N80-12040
Curvature effects on the behavior of laminar boundary layers
N80-12045
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefield hypersonic flow
N80-12050
First pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — Imgley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
An investigation of separated flow about a hemisphere-cylinder at 0- to 19- degree in the Mach number range from 0.6 to 1.5
[AD-A073451] N80-12074
Dimensions of a coherent structure in the potential cone of a subsonic free jet
N80-12313
FLOW EQUATIONS
A method for assessing the impact of wake vortices of USAF operations
[AD-A072967] N80-12072
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
Second order modeling of turbulent flows
N80-12318
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
Application of Numerical methods to Flow calculations in turbomachines
[VKI-LEC-SER-1979-7] N80-12365
Finite element calculations of turbomachinery flows — analysis of finite element method and flow equations in the fluid mechanics of turbomachinery
N80-12367
Time marching methods for turbomachinery flow calculation — time dependence of flow equations for two and three dimensional flow in turbomachinery
N80-12369
Time marching methods for turbomachinery flow calculations: Methods of improving convergence — time dependence and convergence of flow equations in turbomachinery
N80-12370
FLOW MEASUREMENT
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Aeroacoustic characterization of free jets
N80-12025
Experimental investigation of large scale structures in turbulent jet mixing layers
N80-12027
Laser-Raman spectroscopy
N80-12041
Flow measurements in a rotating stall cell
N80-12334
FLOW STABILITY
Perturbed bifurcation theory for plane Poiseuille flow
N80-12305
Eigenvalue bounds and stability of conservative fluid and plasma flows
N80-12575
FLOW THEORY
Unsteady flow in turbomachines, volume 2
[VKI-LEC-SER-1979-3-VOL-2] N80-12331
Computational Fluid Dynamics
[VKI-LEC-SER-1979-6] N80-12358
FLOW VELOCITY
Flame - a slow-flow combustion model
[AD-A072988] N80-12145
FLOW VISUALIZATION
An investigation of separated flow about a hemisphere-cylinder at 0- to 19- degree in the Mach number range from 0.6 to 1.5
[AD-A073451] N80-12074
Improved flow visualization by wise use of Resonant Refractivity
[AD-A073074] N80-12374
FLUID DYNAMICS
Perturbed bifurcation theory for plane Poiseuille flow
N80-12305
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Data acquisition systems and data analysis in fluid dynamics
[VKI-LEC-SER-1979-5] N80-12354
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
FLUID FLOW
Pressure drop and heat transfer in cocurrent downflow of gas-solids suspensions
N80-12308
On some problems in two and single phase flows
N80-12363
Simplified solution algorithms for fluid flow problems
[LA-UR-78-2813] N80-12381
FLUID JETS
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
FLUID MECHANICS
Pressure drop and heat transfer in cocurrent downflow of gas-solids suspensions
N80-12308
Unsteady flow in turbomachines, volume 1
[VKI-LEC-SER-1979-3-VOL-1] N80-12325
Introduction to unsteady flows in turbomachines
N80-12326
Application of Numerical methods to Flow calculations in turbomachines
[VKI-LEC-SER-1979-7] N80-12365
Introduction to numerical methods: Mathematical concepts and fundamental equations — numerical analysis of partial differential, linear, and nonlinear equations in fluid mechanics
N80-12366
Finite element calculations of turbomachinery flows — analysis of finite element method and flow equations in the fluid mechanics of turbomachinery
N80-12367
FLUIDIZED BED PROCESSORS
Transport phenomena in packed bed reactors
N80-12339
FLUORESCENCE
Quasicontinuum physics — intramolecular dynamics in polyatomic molecules
[AD-A073117] N80-12144
Synthesis and photophysical properties of a fluorescent polyamide series and their monomer analogs: Novel intramolecular excimer and exciplex interactions
N80-12175
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352

FLUORIDES
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121
Photochemistry and photophysics of formyl fluoride
N80-12134
FLUORINE
An NMR study of the critical phenomena of MnF2 in a 75 KG field
N80-12929
FLUOROSCOPY
Preliminary applications and evaluation results. Linxcope: Proceedings of the Linxcope Conference
[NASA-CP-2112] N80-12384
The Linxcope concept
N80-12385
A comparison of the Linxcope with other X-ray imaging systems
N80-12390
FLUTTER
Aircraft flutter and dynamic response
N80-12010
Flight flutter testing
N80-12012
Aeroelastic response analysis of two dimensional, single and two degree of freedom airfoils in low-frequency, small-disturbance unsteady transonic flow
[AD-A073379] N80-12073
The development of the DAST 1 remotely piloted research vehicle for flight testing an active flutter suppression control system
N80-12083
Leading edge flutter of supercavitating hydrofoils
[AD-A073382] N80-12236
FLUTTER ANALYSIS
Aeroelastic Problems in Aircraft Design
[VKI-LEC-SER-1979-4] N80-12000
Wind tunnel flutter investigations
N80-12011
Flight flutter testing
N80-12012
FLUX [RATE]
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
FLYWHEELS
The USAF Academy flywheel-electric car preliminary design report
[AD-A071242] N80-12553
Mechanical energy storage technology development for electric and hybrid vehicle applications
[UCRL-81786] N80-12596
Research on the dynamics of band-supported flywheel systems
[SAND-78-7074] N80-12597
FOAMING
Foam solar sea power: A physical investigation
N80-12548
FOREST MANAGEMENT
Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry
N80-12500
FORESTS
Texture analysis as a recognition parameter for different types of forests
N80-12498
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
Forest resource information system, phase 3
[E80-10026] N80-12528
Some potential effects of acid rain on forest ecosystems: Implications of a computer simulation
[BNL-50889] N80-12630
Climatic variability and forestry
N80-12687
FORTRAN
Input and table-handling facility for Fortran programs
[SAND-78-1165] N80-12772
FOSSIL FUELS
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry — automatic test equipment
[FE-2537-9] N80-12193
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Mass spectrometry and fossil-energy conversion technology: A review
[FE-2537-7] N80-12198
FOUNDATIONS
Stabilization and compaction
[PB-298935/8] N80-12244
FOUR BODY PROBLEM
Variational Pade approximants applied to the three- and four-body problem
N80-12944
FOURIER ANALYSIS
Specularity measurements for solar materials — using Fourier transform analysis
[PNL-SA-6831-PT-2] N80-12573
FRACTURE MECHANICS
Fracture toughness characterization of selected ultra high carbon steels
[AD-A073395] N80-12159
Fracture mechanics of inelastic polymers
[AD-A072792] N80-12178
A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436
Near-tip plastic deformations in dynamic fracture mechanics
[AD-A072833] N80-12443
Recommended plan for project FRACT: A critical evaluation of fracture related analytical and computational techniques
[AD-A072773] N80-12447
Fracture behavior and analysis of fiber reinforced concrete beams
[PB-297743/7] N80-12453
FRACTURE STRENGTH
Increased fracture toughness of graphite-epoxy composites through intermittent interlaminar bonding
N80-12119
Fracture toughness characterization of selected ultra high carbon steels
[AD-A073395] N80-12159
Fracture toughness of steel-aluminum deformation welds
[SAND-78-1736] N80-12439
FRACTURES [MATERIALS]
Recommended plan for project FRACT: A critical evaluation of fracture related analytical and computational techniques
[AD-A072773] N80-12447
FRAMES
Large deflection analysis of portal frames
[PB-298741/0] N80-12248
FRANCE
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
TELLUS newsletter 1 — Beauce, France
[E80-10029] N80-12531
FREE BOUNDARIES
Some aspects of the approximation of free surface problems
N80-12360
FREE FLOW
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — langley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
The effects of freestream turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239
Velocity and temperature fields in oscillating boundary layers
N80-12306
An experimental and analytical study of boundary layers in highly turbulent freestreams
[AD-A073006] N80-12376
FREE JETS
Aeroacoustic characterization of free jets
N80-12025
Laser anemometer measurements in a supersonic free jet with a hot gaseous envelope
N80-12312
Dimensions of a coherent structure in the potential cone of a subsonic free jet
N80-12313
FREQUENCY SYNTHESIZERS
Method for shaping and aiming narrow beams — using a linear frequency chirp for sonar reception
[NASA-CASE-NPO-14632-1] N80-12256
FROST
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Aids for forecasting minimum temperature in the Wenatchee frost district
[PB-298339/3] N80-12713
FUEL CELLS
Anion permselective membrane
[NASA-CR-159599] N80-12551
On the properties of a fuel cell electrolyte
[AD-A072864] N80-12554
Commercial application of molten carbonate fuel cell system
[CONF-790213-4] N80-12557
FUEL COMBUSTION
Analysis and modelling of the flow within a turbomachine combustor
N80-12024
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1028] N80-12192
FUEL CONSUMPTION
Engine component improvement program: Performance improvement — fuel consumption
[NASA-TM-79304] N80-12092
FUEL OILS
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1028] N80-12192
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580
FUEL SYSTEMS
Automobile fuel tanks — bibliography
[PB-298933/3] N80-12421
FUEL TANKS
Automobile fuel tanks — bibliography
[PB-298933/3] N80-12421
FUNCTION SPACE
Extensions of functions in Sobolev and Besov spaces
N80-12812
FUNCTIONAL ANALYSIS
Some minimax principles with applications in nonlinear elliptic boundary value problems and global vortex flow
N80-12304
FUNCTIONALS
Linear extremal problems in the class of univalent functions
N80-12779
FUNCTIONS [MATHEMATICS]
Linear extremal problems in the class of univalent functions
N80-12779
Extensions of functions in Sobolev and Besov spaces
N80-12812
Good functions, elementary sets and automata
N80-12813
FURNACES
Emission assessment of conventional stationary combustion systems. Volume I: Gas- and oil-fired residential heating sources
[PB-298496/5] N80-12637
FUSION REACTORS
Economics of fusion driven symbiotic energy systems
[CONF-780602-58] N80-12602
Actinide cross section data and inertial confinement fusion for long term waste disposal
[UCRL-82177] N80-12859
Tandem mirror fusion reactor studies
[UCID-17990] N80-12886
Thermal-hydraulic considerations in magnetically confined fusion reactors
[GA-A-15365] N80-12896
Current status of fusion reactor blanket thermodynamics
[ANL-78-109] N80-12897
Conceptual design of a Demonstration Tokamak Hybrid Reactor [DTHR]
[WFPS-TME-107] N80-12898
FUSION-FISSION HYBRID REACTORS
Systems study of Tokamak fusion-fission reactors
[PPPL-1450] N80-12904

G

GALACTIC NUCLEI
Detection of high energy X-rays from the galactic center region
[NASA-TM-80586] N80-12988
GALACTIC RADIATION
Observations of diffuse galactic gamma rays
[NASA-TM-80578] N80-12985
Detection of high energy X-rays from the galactic center region
[NASA-TM-80586] N80-12988
GALACTIC STRUCTURE
Vertical structure of galactic gaseous disks
N80-12974
Observations of diffuse galactic gamma rays
[NASA-TM-80578] N80-12985
GALAXIES
Vertical structure of galactic gaseous disks
N80-12974
GALLIUM
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
GALLIUM ARSENIDES
Gallium arsenide vertical channel insulated gate field effect transistor
[AD-A073706] N80-12285
The measurement of temperature instabilities and their effect on the liquid phase epitaxial growth of gallium arsenide
[ERL-0077-TR] N80-12931
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072764] N80-12936
GAME THEORY
Stochastic games, oligopoly theory and competitive resource allocation
[AD-A073030] N80-12810
GAMMA RAY ASTRONOMY
Detection of a fast, intense and unusual gamma ray transient
[NASA-TM-80570] N80-12983
GAMMA RAY TELESCOPES
The time-of-flight system on the Goddard medium energy gamma-ray telescope
[NASA-TM-80579] N80-12970
GAMMA RAYS
Observations of diffuse galactic gamma rays
[NASA-TM-80578] N80-12985

GARP ATLANTIC TROPICAL EXPERIMENT
Surface meteorology over the gate a-scale
[REPT-78-6] N80-12659
GAS ANALYSIS
Approaches to level 2 analysis based on level 1 results, MEG categories and compounds, and decision criteria — air pollution monitoring
[EPA-600/7-79-063A] N80-12153
Microprocessor-controlled, programmable ramp voltage generator
[SAND-78-8040] N80-12289
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162480] N80-12623
Optimized chemiluminescence system for measuring atmospheric ammonia
[PB-296048/6] N80-12633
GAS BAGS
Gas sample storage
[PB-298350/9] N80-12152
GAS CHROMATOGRAPHY
Target factor analysis of gas-chromatographic retention indices — multivariate statistical analysis of gas chromatography data for solutions and solvents
N80-12129
GAS DYNAMICS
Transient interactions of laser pulses with matter
N80-12213
Laser velocimeter measurements in a constant volume internal combustion engine simulator
[SAND-78-8721] N80-12400
GAS EXPANSION
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-13706
GAS EXPLOSIONS
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
GAS FLOW
Contributions to fluid mechanics and ballistics — measuring instruments
[BMVG-FBWT-79-3] N80-12310
Velocity measurements on propellant gases in gun tubes
N80-12311
GAS IONIZATION
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
GAS LASERS
Similarity in nozzle flows with vibrational nonequilibrium
N80-12043
Heated electron beam cell study
[AD-A072875] N80-12410
GAS MIXTURES
Vacancy solution and two-dimensional gas models for gas mixture adsorption
N80-12140
The transport properties of dilute gases in applied fields
N80-12906
GAS SPECTROSCOPY
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials — PETN and HNS in explosive components
[SAND-79-0935C] N80-12150
GAS TRANSPORT
ATMAS: A three-dimensional atmospheric transport model to treat multiple area sources
[UCRL-52603] N80-12627
GAS TUNGSTEN ARC WELDING
Weldability of electroformed nickel
[Y-2171] N80-12172
GAS TURBINES
Validation of the Detroit Diesel Allison logistic support cost model [program OS 590]
[AD-A072670] N80-12094
Computation of discrete hole film cooling flow using the Navier-Stokes equations — gas turbine blades
[AD-A073057] N80-12096
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-155-010] N80-12291
GAS-SOLID INTERFACES
Pressure drop and heat transfer in cocurrent downflow of gas-solids suspension
N80-12308
GAS-SOLID INTERFACES
Estimates for wet and dry removals contribution to the residence time for atmospheric pollutants in the eastern United States
[SR-0980-6] N80-12626
GASEOUS DIFFUSION
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
GASIFICATION
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2265-2] N80-12191
GASOHOL [FUEL]
Constant relationships within two-phase gasoline/methanol/water systems
[BETC/RI-78/6] N80-12203
GASOLINE
Component relationships within two-phase gasoline/methanol/water systems
[BETC/RI-78/6] N80-12203
GATES [CIRCUITS]
Gallium arsenide vertical channel insulated gate field effect transistor
[AD-A073706] N80-12285
GAUGE INVARIANCE
Particle production in high-energy reactions and studies in a gauge model
N80-12048
GAW-2 AIRFOIL
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% dot-lip spoiler
[NASA-CR-3081] N80-12053
GENERAL AVIATION AIRCRAFT
Rotary balance data for a typical single-engine general aviation design for an angle-of-attack range of 8 degrees to 35 degrees, 3. Effect of wing leading-edge modifications, model A
[NASA-CR-3102] N80-12060
GEOCHEMISTRY
A global geochemical model for the evolution of the mantle
[NASA-CR-162902] N80-12644
GEOCHRONOLOGY
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669
Climates of past geological epochs — paleogeography
N80-12670
GEODESY
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Progress in photogrammetric point determination by compensation of systematic errors and detection of gross errors
N80-12462
Texture analysis by means of synthetic impulse functions
N80-12466
GEOGRAPHY
Climates of past geological epochs — paleogeography
N80-12670
GEOLOGICAL SURVEYS
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521
Method of analysis and precision of X-ray diffraction data from Ohio shale — used in geological survey of black shales
[METC/CR-78/16] N80-12541
Geological assessment probe
[NASA-CASE-NPO-14559-1] N80-12642
GEOMAGNETIC MICROPULSATIONS
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639
GEOMAGNETISM
Annual mean values of geomagnetic components for selected observatories, 1940 - 1973
[PB-298716/2] N80-12653
GEOMORPHOLOGY
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
Guidelines for the use of structural versus regression analysis in geomorphic studies
[PB-298360/9] N80-12655
GEOPHYSICAL OBSERVATORIES
Annual mean values of geomagnetic components for selected observatories, 1940 - 1973
[PB-298716/2] N80-12653
GEOPHYSICS
Scattering of electromagnetic waves by obstacles in presence of the earth's surface current distribution on perfectly conducting cylindrical loops in an incident
[AD-A072890] N80-12273
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Information theory and the earth's density distribution
[NASA-TM-80580] N80-12643
GEOSYNCHRONOUS ORBITS
Specification of the natural plasma environment at geosynchronous orbit
[AD-A073160] N80-12883
GEOTHERMAL ENERGY CONVERSION
Comparison of geothermal energy with coal, oil, and natural gas for selected uses
[DOE/ET-27139-1] N80-12558
Using surface waters for supplementing injection at the Salton Sea Geothermal Field [SSGF], Southern California
[UCRL-83011] N80-12561
Hybrid staging of geothermal energy conversion processes
[UCID-17949] N80-12569
New concepts for converting the energy in low-to medium-temperature liquids, with emphasis on geothermal applications
[UCRL-52583] N80-12570
Waste heat rejection from geothermal power stations
[ORNL/TM-6533] N80-12575
GERMANIUM
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294
Studies of hopping and correlated hopping in p-type germanium by piezo-magneto-resistance measurements — effect of magnetic field and stress on germanium using a piezoelectric gage
N80-12914
Intervalley transfer in n-type germanium at 77 deg K
N80-12928
GERMANY
Research into determining chemical parameters at the surface of the sea by remote sensing
N80-12479
Colored substance mixing experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Multispectral classification of sand bank regions — Germany
N80-12481
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Making morphological maps of sand banks from aerial photographs
N80-12483
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-12487
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
Development of processing methods for images of the Jade coast region and experience acquired
N80-12504
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
GIMBALS
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation — surface navigation
[AD-A073153] N80-12081
GLASS
Structure of some refractory transition metal metalloid glasses
[CALT-822-105] N80-12162
Specularity measurements for solar materials — using Fourier transform analysis
[PNL-SA-6031-FT-2] N80-12573
GLASS FIBER REINFORCED PLASTICS
On the probability of crack propagation in a unidirectional composite with a single fiber breakage
[ESA-TT-524] N80-12125
GLASS FIBERS
Lifetime prediction for optical glass fibers
[AD-A072771] N80-12872
GLOBAL AIR POLLUTION
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
Climate at the millennium
N80-12666
GLOBAL POSITIONING SYSTEM
The impact of global positioning system on guidance and controls systems design of military aircraft, volume 1
[AGARD-AR-147-VOL-1] N80-12082
GOLD COATINGS
Feasibility of electroplated gold for hybrid microcircuits
[BDX-613-2114] N80-12290
GOVERNMENT/INDUSTRY RELATIONS
Forest resource information system, phase 3
[E80-10026] N80-12528
The great adventure: A report on the 10 regional public hearings on solar energy for the domestic policy review
[HCP/U6354-01] N80-12567

GRAIN BOUNDARIES
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352

GRANULAR MATERIALS
Hot spot phenomena in active packed beds
N80-12351

GRAPHITE-EPOXY COMPOSITE MATERIALS
Second generation PMR polyimide/fiber composites
[NASA-CR-159666] N80-12118
Increased fracture toughness of graphite-epoxy composites through intermittent interlaminar bonding
N80-12119
Mechanical property characterization of intraply hybrid composites
[NASA-TM-79306] N80-12120
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121
Effects of thermal spiking on graphite-epoxy composites
[AD-A072825] N80-12122
Test and evaluation of graphite/epoxy composite structure
[AD-A072778] N80-12123

GRAPHS [CHARTS]
Matching algorithms — for finding optimum weight perfect matching in a graph
N80-12757
Assessment of procedures and preliminary software design for fault tree synthesis
[UCRL-13919] N80-12773

GRASSLANDS
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525

GRATINGS [SPECTRA]
Dielectric grating antennas
[AD-A073261] N80-12262

GRAVITATION THEORY
Cosmological tests of a scale covariant theory of gravitation
N80-12976
Black holes and cosmic censorship
N80-12977

GRAVITATIONAL EFFECTS
Black holes and cosmic censorship
N80-12977

GRAVITATIONAL FIELDS
Gravitational and electromagnetic potentials of the stationary Einstein-Maxwell field equations
N80-12641

GRAZING INCIDENCE
Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820

GREAT PLAINS CORRIDOR [NORTH AMERICA]
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524

GREENHOUSE EFFECT
Human activities that effect climate — greenhouse effect
N80-12674

GREENLAND
Tide tables 1980. High and low water predictions. East Coast of North and South America including Greenland
[PB-298726/1] N80-12725

GRINDING [MATERIAL REMOVAL]
Abrasive machining of major components
[AD-A071916] N80-12415

GROUND EFFECT
Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820

GROUND EFFECT [AERODYNAMICS]
The criticality of engine exhaust simulations on VSTOL model-measured ground effects
[AD-A073114] N80-12093

GROUND STATE
Microwave spectra and theoretical calculation of transient molecules — determining the ground state and dipole moment
N80-12828
Ground state energy of molecular trimers
N80-12832

GROUND STATIONS
Low sidelobe level low-cost earth station antennas for the 12 GHz broadcasting satellite service
[NASA-CR-159703] N80-12259

GROUND TESTS
New methods for ground tests of aeronautical structures
N80-12006

GROUND TRUTH
SEASAT: Gulf of Alaska experiment. Surface truth data inventory
[PB-294616] N80-12546

GROUND WATER
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution
[E80-10002] N80-12518
Application of a method for comparing one-dimensional and two-dimensional models of a ground-water flow system
[UCRL-52561] N80-12545

GROUND WAVE PROPAGATION
Ground wave propagation over irregular, inhomogeneous terrain: Comparisons of calculations and measurements
[PB-298668/5] N80-12275

GROUND-AIR-GROUND COMMUNICATIONS
Performance and impairments in a QPSK satellite to ground link
N80-12218

GROUP THEORY
Finite group actions on simply-connected manifolds and CW complexes
N80-12778

GUIDANCE [MOTION]
Minicomputer applications in automated testing of electro-optical guidance systems
[AD-A073092] N80-12407

GUIDE VANES
Design, durability and low cost processing technology for composite fan exit guide vanes
[NASA-CR-159677] N80-12091

GULF OF MEXICO
SEASAT: Gulf of Alaska experiment. Surface truth data inventory
[PB-294616] N80-12546

GUN PROPELLANTS
Velocity measurements on propellant gases in gun tubes
N80-12311

H

HAL/S [LANGUAGE]
Programming in HAL/S
[NASA-CR-162501] N80-12766

HAMILTONIAN FUNCTIONS
Hydrodynamic model wavefunctions in intrinsic coordinates and their application to the structure of even-even nuclei
[IS-T-825] N80-12847

HAMSTERS
Combined effects of polycyclic aromatic hydrocarbons and sunlight — on Chinese hamster V79 cells
[CONF-790447-4] N80-12631

HARMONIC ANALYSIS
Random harmonic analysis program, L221 [TEV156]. Volume 1: Engineering and usage
[NASA-CR-2857] N80-13058

HARMONIC OSCILLATION
Velocity and temperature fields in oscillating boundary layers
N80-12306

HAWAII
Summer weather on Haleakala, Maui
[UHMET-79-09] N80-12708

HEAT BUDGET
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523

HEAT CAPACITY MAPPING MISSION
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution
[E80-10002] N80-12518
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
TELLUS newsletter 1 — Beauce, France
[E80-10029] N80-12531

HEAT EXCHANGERS
Survey and description of transport phenomena in packed-beds — for thermal energy storage
N80-12340
Dynamic response of a packed-bed energy storage system to a time varying inlet temperature
N80-12341
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Fundamentals of Regenerators
N80-12347
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
Air-to-air heat exchangers: Saving energy and improving indoor air quality
[LBL-9381] N80-12380
Thermoelectric ocean thermal energy conversion
[SERI/TP-35-254] N80-12564
Operational experience with drain-down solar systems
[IS-M-166] N80-12576

HEAT FLUX
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319

HEAT MEASUREMENT
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925

HEAT OF FORMATION
Application of packed beds to energy storage use of latent heat of fusion
N80-12353

HEAT PUMPS
Assist of an air-to-air heat pump using solar heated hot water
N80-12413
Optimization of photovoltaic/thermal collector heat pump systems
[COO-4577-7] N80-12566
Research and development of a heat and pump water heater, volume 1
[ORNL/SUB-7321-1] N80-12613

HEAT RESISTANT ALLOYS
Application of sputtering to the improvement of coatings of superalloys
N80-12017
Ductility minimum and its reversal with aging in cobalt-base superalloys
[ORNL/TM-6624] N80-12170

HEAT STORAGE
Fluid Dynamics of Porous Media in Energy Applications, volume 1 — heat storage and transfer in solar energy conversion systems
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
Survey and description of transport phenomena in packed-beds — for thermal energy storage
N80-12340
Dynamic response of a packed-bed energy storage system to a time varying inlet temperature
N80-12341
Heat storage and thermal transfer aspects of the dynamic behaviour of a packed bed
N80-12342
Application of porous media to heat storage underground
N80-12345
Effect of operating temperatures on the cost of energy from solar thermal electric power plants
[SAND-79-0801] N80-12563
Low-temperature thermal energy storage program annual operating plan
[ORNL/TM-6605] N80-12568
Materials problems in reversible chemical reaction storage systems for solar energy
[SAND-78-8693] N80-12574
Performance of Los Alamos solar Mobile/Modular Home Unit no. 1
[LA-UR-78-2587] N80-12577

HEAT TRANSFER
Fluid Dynamics of Porous Media in Energy Applications, volume 1 — heat storage and transfer in solar energy conversion systems
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
Heat storage and thermal transfer aspects of the dynamic behaviour of a packed bed
N80-12342
Heat transfer in a column packed with spheres
N80-12343
General and particular aspects of the particulate bed behaviour in the Post Accident Heat Removal situation for Liquid Metal Fast Breeder Reactors
N80-12349
Application of packed beds to energy storage use of latent heat of fusion
N80-12353

HEAT TRANSFER COEFFICIENTS
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350
Hot spot phenomena in active packed beds
N80-12351

HEATING EQUIPMENT
Emissions assessment of conventional stationary combustion systems. Volume 1: Gas- and oil-fired residential heating sources
[PB-296894/6] N80-12637
HEAVY IONS
X-ray emission in heavy-ion collision
[ORO-4036-1] N80-12843
Complementarity between neutron capture and heavy-ion reactions in nuclear structure studies
[LA-UR-78-2432] N80-12863
HEIGHT
Height interpolation by the method of finite elements
N80-12460
HELICOPTER DESIGN
ONERA aerodynamic research work on helicopters
N80-12030
HELICOPTERS
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
Helicopter canopy internal reflection investigation
[AD-A073084] N80-12867
HELIOSTATS
Solar-powered steam generator heliostat
[BNL-50974] N80-12610
HELIUM
Electron-impact excitation of n = 2 levels of helium at intermediate energies
[ORO-4881-24] N80-12846
HELIUM ATOMS
The he I triplet line emission in class 1 Seyfert galaxies
N80-12972
HELIUM ISOTOPES
Superfluid helium three: Some hydrodynamic measurements
N80-12131
HETEROGENEITY
On some problems in two and single phase flows
N80-12363
HETEROJUNCTION DEVICES
Transport theory of carriers across semiconductor heterojunction interfaces
N80-12280
HEXAGONAL CELLS
Theory of interstitial ordering in alloys with hexagonal close-packed crystal lattice
[IS-TRANS-106] N80-12937
HEXANITROSTILBENE
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials — PETN and HNS in explosive components
[SAND-79-0935C] N80-12150
HIERARCHIES
Application of a hierarchial classification method for special problems — correcting direction dependent variations in recorded signals
N80-12502
Directions for memory hierarchies and their components: Research and development
[LBL-8276] N80-12752
HIGH ALTITUDE
Wind study for high altitude platform design
[NASA-RP-1044] N80-12661
HIGH ALTITUDE BALLOONS
Design and analysis of single cell balloons — stress analysis of high altitude balloons
[AD-A072828] N80-12068
HIGH ENERGY INTERACTIONS
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12941
Particle production in high-energy reactions and studies in a gauge model
N80-12848
High energy accelerator and colliding beam user group
[ORO-2504-273] N80-12857
HIGH ENERGY PROPELLANTS
Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12814
HIGH POWER LASERS
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933
HIGH PRESSURE
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
A study of the optical and transport properties of the ternary semiconducting compounds AlnGa1-nAs high pressure
N80-12911
High pressure studies of ionic conductivity in solids — high pressure study of ionic mobility and conductivity in crystal lattices
[SAND-79-1511C] N80-12943
HIGH SPEED CAMERAS
Framing of spark discharges
N80-12215
HIGH STRENGTH ALLOYS
Evaluation of high chromium overplays to protect less alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163
HIGH TEMPERATURE
Austenitic stainless steel-to-ferritic steel transition joint welding for elevated temperature service
[CONF-781006-1] N80-12417
The dynamic response of elastic isotropic thin circular cylindrical shells to intense heat
N80-12426
Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912
HIGH TEMPERATURE GASES
Laser anemometer measurements in a supersonic free jet with a hot gaseous envelope
N80-12312
HIGH TEMPERATURE PLASMAS
High temperature facility for atomic physics studies — test facilities for laser heating high temperature plasmas
[UCRL-13969] N80-12840
HIGH TEMPERATURE TESTS
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
HIGHWAYS
Bridge deck joint-sealing system: Evaluation and performance specification
[PB-298942/4] N80-12184
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185
Failure and repair of continuously reinforced concrete pavement
[PB-298832/7] N80-12246
Durability of concrete bridge decks
[PB-298829/3] N80-12247
Performance of continuously reinforced concrete pavement in Illinois
[PB-298495/3] N80-12249
Performance of buried flexible conduits — highways
[PB-298224/7] N80-12250
HOLE MOBILITY
Collective effects, relaxation and localization of hole levels in atoms, molecules, solids, and adsorbates
[BNL-26068] N80-12940
HOLES
Stresses in the neighborhood of loaded holes in wood with application to bolted joints
N80-12427
HOLOGRAPHIC INTERFEROMETRY
On the solution of a certain linear least squares fit problem
[AD-A072689] N80-12792
Optical fringe analysis techniques, volume I
[AD-A072714] N80-12868
HOLOGRAPHY
The use of holography for kinetic energy measurements of target splinters
N80-12209
Digital recording using hologram arrays: Developments of the transducers for an experimental 100Mbit/s recorder
[BBC-RD-1979/16] N80-12382
Optical mass memory investigations. Volume 3: Considerations for the development of a DIGIMEM archival optical mass storage system
[NASA-CR-162460] N80-12745
Holographic spectral analysis
[AD-A072715] N80-12869
HOMOGENEOUS TURBULENCE
Pathological cases in turbulent field and spectral approach
N80-12321
HOMOGENIZING
Homogenization of static thermoelastic properties of media with periodic structures
N80-12028
HOMOTOPY THEORY
Finite group actions on simply-connected manifolds and CW complexes
N80-12778
HORN ANTENNAS
Analysis and synthesis of corrugated conical horns
N80-12223
A method for computing corrugated horns phase center
N80-12224
Reflector antennas with high efficiency and low depolarization
N80-12228
HOT SURFACES
Hot spot phenomena in active packed beds
N80-12351
HUMAN FACTORS ENGINEERING
The effectiveness of two and three dimensional isarithmic surfaces in communicating magnitude, gradient, and pattern information
N80-12454
A postural measurement system for induced body sway assessment
N80-12729
Single pilot scanning behavior in simulated instrument flight
[NASA-TM-80178] N80-12732
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740
HUMAN PERFORMANCE
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740
Measuring inter-rater reliability of dichotomous responses: A components of variance approach
N80-12797
HUMIDITY
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Catchment, north west of London, U.K.
[E80-10006] N80-12522
HURRICANES
Comparison of LFM and MFM precipitation guidance for Nevada during dorcen
[PB-298613/1] N80-12715
HYBRID CIRCUITS
Feasibility of electroplated gold for hybrid microcircuits
[BDX-613-2114] N80-12290
HYDRAULIC EQUIPMENT
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
HYDRAULIC JETS
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
HYDROCARBON COMBUSTION
Influence of turbulence on hydrocarbon combustion in a stirred combustor
[ESA-TT-580] N80-12151
HYDROCARBON FUELS
Characterization and combustion of SRC 2 fuel oil
[EPRI-FP-1028] N80-12192
Environmental aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12201
HYDROCLIMATOLOGY
Climate variability and the design and operation of water resource systems
N80-12678
HYDROCRACKING
Status of the PEATGAS process
[CONF-781045-3] N80-12199
HYDRODYNAMICS
Superfluid helium three: Some hydrodynamic measurements
N80-12131
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Computation of water waves
[AD-A072944] N80-12375
Hydrodynamic model wavefunctions in intrinsic coordinates and their application to the structure of even-even nuclei
[IS-T-825] N80-12847
HYDROFOILS
Leading edge flutter of supercavitating hydrofoils
[AD-A073382] N80-12236
HYDROGEN
Rayleigh temperature profiles in a hydrogen diffusion flame
[SAND-78-8726] N80-12148
FT-NMR determination of silane hydrogen
[MHSMP-78-45] N80-12181
Parity violation in the scattering of 15 MeV protons by hydrogen
[LA-UR-78-2875] N80-12835
Results of duct area ratio changes in the NASA Lewis H2-O2 combustion MHD experiment
[NASA-TM-79308] N80-12881
HYDROGEN CLOUDS
On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973
HYDROGEN FUELS
The future role of hydrogen fuel in an electrical society
[UTIAS-241] N80-12189
HYDROGEN PRODUCTION
Thermochemical production of hydrogen from water, a critical review
[LA-UR-78-2996] N80-12196
LASL thermochemical hydrogen program status on October 31, 1978 — fusion-synfuel
[LA-UR-78-2895] N80-12197
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605
HYDROGEN RECOMBINATIONS
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
HYDROGRAPHY
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
HYDROLYSIS
The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177

HYDROMETEOROLOGY
Collection and measurement efficiencies of the EWER cloud water meter for hydrometeors
[AD-A072827] N80-12700
HYDROSTATIC PRESSURE
Hydrostatic pressure effects on the motional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12910
HYDROSTATICS
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12420
HYDROXIDES
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116
HYDROXYL RADICALS
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135
HYPERBOLIC DIFFERENTIAL EQUATIONS
Numerical methods for hyperbolic partial differential equations
N80-12399
HYPERSONIC AIRCRAFT
Aerodynamic characteristics of a hypersonic research airplane concept having a 70 deg swept double-delta wing at Mach numbers from 0.80 to 1.20, with summary of data from 0.20 to 6.0 — Langley 8-ft transonic wind tunnel
[NASA-TP-1552] N80-12064
HYPERSONIC FLOW
Flow field investigations in corner regions in hypersonic flow
N80-12040
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefield hypersonic flow
N80-12050
Improvements to the solution of the viscous shock layer equations
[AD-A072673] N80-12071
HYPERSONICS
Application of supersonic linear theory and hypersonic impact methods to three nonslender hypersonic airplane concepts at Mach numbers from 1.10 to 2.86
[NASA-TP-1539] N80-12065

I

ICE
Laboratory investigations of cloud forming nuclei and aerosol particles from unpressurized burns of space shuttle propellant
[NASA-CR-160358] N80-12664
ICE NUCLEI
Airborne measurements of cloud-forming nuclei and aerosol particles in stabilized ground clouds produced by solid rocket booster firings
[NASA-CR-160357] N80-12663
IGNITION
Flame - a slow-flow combustion model
[AD-A072988] N80-12145
ILLINOIS
Performance of continuously reinforced concrete pavement in Illinois
[PB-298495/3] N80-12249
IMAGE CONTRAST
Contrast enhancement methods for video systems
[AD-A073076] N80-12264
IMAGE CORRELATORS
Automatic data acquisition for digital height model
N80-12465
IMAGE ENHANCEMENT
Contrast enhancement methods for video systems
[AD-A073076] N80-12264
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401
IMAGE PROCESSING
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Geometrical analysis and rectification of LANDSAT MSS imagery: Comparison of different methods
N80-12457
Height interpolation by the method of finite elements
N80-12460
Interactive correction of classified photographs
N80-12503
Development of processing methods for images of the Jade coast region and experience acquired
N80-12504
Digital processing procedure for texture analysis with remote sensing data
N80-12505
Geometrical restitution of multispectral scanning images
N80-12506
Evaluations in the framework of the FMP program using the digital image processing system DIDAK
N80-12507
IMAGE RESOLUTION
Contrast enhancement methods for video systems
[AD-A073076] N80-12264
Auto- and cross-correlation of image coordinates
N80-12456
IMAGES
Some contemplated improvements to the prototype Lixiscope
N80-12389
IMAGING TECHNIQUES
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
IMPACT DAMAGE
Impact damage on titanium leading edges from small soft body objects
[AD-A072705] N80-12095
IMPACTORS
Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/8] N80-12402
IMPULSE GENERATORS
Texture analysis by means of synthetic impulse functions
N80-12466
INCOMPRESSIBLE FLOW
Direct numerical simulation of turbulence
N80-12320
The computation of three dimensional viscous flows
N80-12362
INDIUM ALLOYS
The magnetic susceptibility of the liquid bismuth-indium alloy system
N80-12126
Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925
INDUSTRIAL ENERGY
Effects of energy policy on industry
[USFFE-1978-8] N80-12604
INDUSTRIAL WASTES
Research into determining chemical parameters at the surface of the sea by remote sensing
N80-12479
Evaluation of a developmental heavy metals waste treatment system
[AD-A073131] N80-12959
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963
INELASTIC SCATTERING
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
INFESTATION
Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops
N80-12497
INFINITY
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
INFORMATION DISSEMINATION
Better information management policies needed: A study of scientific and technical bibliographic services
[PB-298776/6] N80-12953
INFORMATION FLOW
Data requirements for oceanic processes in the open ocean, coastal zone, and cryosphere
[NASA-CR-162451] N80-12719
INFORMATION MANAGEMENT
IMS 11: An Information on Management System for the PDP 11 computer
[PB-298731/1] N80-12756
INFORMATION RETRIEVAL
Search algorithms and related techniques for the analysis of spectrometric data
N80-12137
High-speed graphics terminal interface for a PDP-11 minicomputer
[LA-7840-MS] N80-12754
Mechanical intelligence: Research and applications
[AD-A073127] N80-12952
INFORMATION SYSTEMS
Forest resource information system, phase 3
[E80-10026] N80-12528
Applications of the knowledge of climate
N80-12695
Data requirements for oceanic processes in the open ocean, coastal zone, and cryosphere
[NASA-CR-162451] N80-12719
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]
[AD-A072947] N80-12950
Implications of an all-digital Navy technical information presentation system
[AD-A073095] N80-12951
INFORMATION THEORY
Digital signal analysis: Theory and applications
N80-12355
Information theory and the earth's density distribution
[NASA-TM-80586] N80-12643
Statistical inference in Markov chains using the principal of minimum discrimination information
N80-12801
INFRARED LASERS
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404
INFRARED PHOTOGRAPHY
Interpretation of IR and MSS data for town areas
N80-12485
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-12487
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field
[NASA-TM-80328] N80-12532
INFRARED RADIATION
Routine spectral measurements of infrared radiation from the atmosphere
[LBL-8777] N80-12652
INFRARED RADIOMETERS
Numerical treatment of IR thermal data for the German Bight test region
N80-12474
Determination of soil water contents from radiometric measurements and IR scanning data
N80-12494
INFRARED SCANNERS
Evaluation of thermal images of the Jade region
N80-12475
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
Determination of soil water contents from radiometric measurements and IR scanning data
N80-12494
INFRARED SPECTRA
Refinement of plume modeling in the infrared spectral region
[AD-A072725] N80-12113
INFRARED SPECTROMETERS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
Spectrometer for the first Spacelab payload
N80-12034
INFRARED SPECTROSCOPY
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials — PETN and HNS in explosive components
[SAND-79-0935C] N80-12130
INITIATION
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073058] N80-12146
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195
INLET FLOW
Inlet distortion effects in axial compressors
N80-12327
Steady pressure distortions
N80-12330
Temperature distortion — in a compressor inflow
N80-12332
Unsteady pressure distortion — in compressor inflow
N80-12333
INLET NOZZLES
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
INPUT/OUTPUT ROUTINES
Research study: Device technology STAR router user's guide — automated layout of large scale integration discreticonary interconnection masks
[NASA-CR-161213] N80-12765
Input and table-handling facility for Fortran programs
[SAND-78-1165] N80-12772
INSTRUMENT FLIGHT RULES
Single pilot scanning behavior in simulated instrument flight
[NASA-TM-80178] N80-12732
INSTRUMENTS
Helicopter canopy internal reflection investigation
[AD-A073084] N80-12867
INTAKE SYSTEMS
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019
Influence of the flow field around an inclined egive-cylinder body upon supersonic aft-intakes
N80-12038
INTEGRAL EQUATIONS
High-order accurate solution of Laplace's equation on general regions using integral equation methods and fast Poisson solvers
N80-12781

INTEGRATED CIRCUITS
AFAL simulation facility/capability manual. Volume 2: Executive summary. Computer aided design for microelectronics
[AD-A073983] N80-12283
Analysis of latch-up prevention in CMOS IC's using an epitaxial-buried layer process
[SAND-78-1649] N80-12292
INTEGRATED ENERGY SYSTEMS
Development of a joint-cost-allocation manual for Integrated Community Energy Systems [ICES]
[ANL/ICES-TM-20] N80-12581
INTERFEROMETERS
Synthesis of flight results of the Cactus accelerometer for accelerations below one billionth G
N80-12033
Optical gyroscope system
[NASA-CASE-NPO-14298-1] N80-12383
The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162480] N80-12623
INTERFEROMETRY
Holographic spectral analysis
[AD-A072715] N80-12809
INTERIOR BALLISTICS
Contributions to fluid mechanics and ballistics — measuring instruments
[BMVG-FBWT-79-3] N80-12310
Velocity measurements on propellant gases in gun tubes
N80-12311
Measurements in interior ballistics, transducers, sensors
N80-12316
INTERMEDIATE FREQUENCIES
Application of advanced on-board processing concepts to future satellite communications systems
[NASA-CR-159682] N80-12260
Application of advanced on-board processing concepts to future satellite communications systems: Bibliography
[NASA-CR-159684] N80-12261
INTERMOLECULAR FORCES
Quasicontinuum physics — intermolecular dynamics in polyatomic molecules
[AD-A073117] N80-12144
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
INTERNAL COMBUSTION ENGINES
Laser velocimeter measurements in a constant volume internal combustion engine simulator
[SAND-78-8721] N80-12400
Toward a comprehensive model for combustion in a direct injection stratified charge engine
[LA-UR-79-3223] N80-12418
INTERNAL WAVES
Description of nonlinear internal wave interactions using Langevin methods
[AD-A069610] N80-12721
INTERNATIONAL COOPERATION
International cooperation in remote sensing
N80-12471
The declaration of the World Meteorological Conference: An appeal to nations
N80-12693
Climate data
N80-12694
INTERNATIONAL SUN EARTH EXPLORER 1
Micropulsations in the electric field near the plasmapause, observed by ISEE-1
[NASA-TM-80580] N80-12986
INTERNATIONAL SYSTEM OF UNITS
Dimensions/NBS, volume 63, no. 7/8
[PB-298372/4] N80-12242
INTERPLANETARY SPACE
On the acceleration of energetic protons by interplanetary shock waves
N80-12975
INTERPOLATION
Height interpolation by the method of finite elements
N80-12460
INTERSTELLAR MATTER
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
INTERSTITIALS
Theory of interstitial ordering in alloys with hexagonal close-packed crystal lattice
[PB-TRANS-106] N80-12937
INVENTORY CONTROLS
Statistical methods for evaluating sequential material balance data
[NUREG-CR-0603] N80-12809
INVISCID FLOW
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
Two-dimensional vortical motion
N80-12303
ION BEAMS
Single crystal defect studies by means of ion channeling
N80-12917
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
ION CURRENTS
Effects of additives and moisture on the ionic conductivity of Li_5MO_4 [M = Al, Ga, Fe]
[SAND-79-0543C] N80-12939
ION EXCHANGING
Numerical solutions to problems in liquid membrane electrochemistry
N80-12136
ION IMPLANTATION
Method of making V-MOS field effect transistors
[NASA-CASE-GSC-12515-1] N80-12281
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933
ION MOTION
Hydrostatic pressure effects on the motional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12930
ION PLATING
Preparation and characterization of hydrogenated amorphous silicon thin films and thin film solar cells produced by ion plating techniques
[SAN-1846-T1] N80-12560
ION SCATTERING
Electron conductivity mobility in semiconductors based on a dielectric function modification of the Dingle impurity ion potential
N80-12922
ION SELECTIVE ELECTRODES
Ion electrodes selective for organic functional groups
N80-12114
ION SOURCES
Field electron and ion source research for high density information storage system
[AD-A073701] N80-12286
Miniature cyclotron resonance ion source using small permanent magnet
[NASA-CASE-NPO-14324-1] N80-12851
Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932
IONIC COLLISIONS
Two-body positive ion-negative neutralization
[AD-A073145] N80-12646
IONIC DIFFUSION
Radial diffusion of resonant particles in tandem mirrors — ionic diffusion of resonant particles in mirrors is derived from kinetic theory
[UCID-17992] N80-12902
IONIC MOBILITY
High pressure studies of ionic conductivity in solids — high pressure study of ionic mobility and conductivity in crystal lattices
[SAND-79-1511C] N80-12943
IONIZATION
Experimental study of low-energy charge transfer in nitrogen
[NASA-TM-80156] N80-12390
Na beta-alumina: Structure analysis of a superionic conductor
N80-12934
IRON
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
IRON ALLOYS
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157
IRRIGATION
Technical and economic assessment of solar powered water pumping for remote areas
[SAND-79-8187] N80-12608
ISOTOPES
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
ISOTOPIC LABELING
Improved capabilities to detect incipient bearing failures
[AD-A073123] N80-12416
ISOTROPIC TURBULENCE
Pathological cases in turbulent field and spectral approach
N80-12321
ISOTROPY
Structural inelasticity 23: A piecewise linear theory of plasticity for an initially isotropic material in plane stress
[AD-A073008] N80-12445
ITALY
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
IVORY COAST
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591

J

JET AIRCRAFT NOISE
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Aeroacoustic characterization of free jets
N80-12025
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
JET EXHAUST
Aeroacoustic characterization of free jets
N80-12025
The criticality of engine exhaust simulations on VSTOL model-measured ground effects
[AD-A073114] N80-12093
JET MIXING FLOW
Experimental investigation of large scale structures in turbulent jet mixing layers
N80-12027
A generalized base-flow analysis with initial boundary-layer and chemistry effects
[AD-A072663] N80-12377
JET PROPULSION
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-12036
JOINTS [JUNCTIONS]
Bridge deck joint-sealing system: Evaluation and performance specification
[PB-299942/4] N80-12184
JOURNAL BEARINGS
Oil whirl and critical instabilities in rotor-bearing systems
N80-12412
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12420
JUNCTION TRANSISTORS
Electrical overstress program
[AD-A073140] N80-12422

K

KALMAN FILTERS
Restimation of missile trajectories by Kalman filtering-smoothing
N80-12023
Computer aided design of suboptimal constant gain filters subject to stability constraints
N80-12098
KANSAS
A study of the tolerance block approach to special stratification — winter wheat in Kansas
[E80-10027] N80-12529
Guidelines for the use of structural versus regression analysis in geomorphic studies
[PB-294360/9] N80-12655
KENYA
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
KINETIC ENERGY
The use of holography for kinetic energy measurements of target splinters
N80-12209
KINETIC THEORY
Radial diffusion of resonant particles in tandem mirrors — ionic diffusion of resonant particles in mirrors is derived from kinetic theory
[UCID-17992] N80-12902
KINETICS
Spreading kinetics of a liquid drop on a solid surface
N80-12307

L

LAGRANGE COORDINATES
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195
LAMINAR BOUNDARY LAYER
Separation of a flow along a line of a smooth surface
N80-12022
Curvature effects on the behavior of laminar boundary layers
N80-12045
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
LAMINAR FLOW
An artificial viscosity method for the design of supercritical airfoils
N80-12051
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818

Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819

LAMINATES
Increased fracture toughness of graphite-epoxy composites through intermittent interlaminar bonding
N80-12119

LAND USE
TELLUS newsletter 1 — Brance, France
[E80-10029] N80-12531
Climatic change and the exploitation of climatic resources in China
N80-12684
Climatic variability and land use: An African perspective
N80-12686

LANDSAT SATELLITES
Geometrical analysis and rectification of LANDSAT MSS imagery: Comparison of different methods
N80-12457
Multispectral classification of sand bank regions — Germany
N80-12481

LANGEVIN FORMULA
Description of nonlinear internal wave interactions using Langevin methods
[AD-A069010] N80-12721

LANTHANUM
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927

LANTHANUM COMPOUNDS
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116

LANTHANUM FLUORIDES
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-78-XX-95] N80-12938

LAPLACE EQUATION
High-order accurate solution of Laplace's equation on general regions using integral equation methods and fast Poisson solvers
N80-12781

LARGE AREA CROP INVENTORY EXPERIMENT
A study of the tolerance block approach to special stratification — winter wheat in Kansas
[E80-10027] N80-12529

LARGE SCALE INTEGRATION
An introduction to the BANNING design automation system for shuttle microelectronic hardware development
[NASA-TM-80831] N80-12282
Research study: Device technology STAR router user's guide — automated layout of large scale integration discretionary interconnection masks
[NASA-CR-161213] N80-12765

LASER ANEMOMETERS
Contributions to fluid mechanics and ballistics — measuring instruments
[BMVG-FBWT-79-3] N80-12310
Laser anemometer measurements in a supersonic free jet with a hot gaseous envelope
N80-12312
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314

LASER APPLICATIONS
An investigation of separated flow about a hemisphere-cylinder at 0- to 19- degree in the Mach number range from 0.6 to 1.5
[AD-A073451] N80-12074
Naval blue-green single-pulse downlink propagation model
[AD-A071780] N80-12406
Kinetic spectroscopy of metal atom/oxidizer chemiluminescent reactions for laser applications
[AD-A073082] N80-12411

LASER DAMAGE
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933

LASER DOPPLER VELOCIMETERS
The development of passive Doppler techniques in LRSL/ISL and their applications to ballistic and aerodynamic measurements
N80-12210
Contributions to fluid mechanics and ballistics — measuring instruments
[BMVG-FBWT-79-3] N80-12310
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314
Scanning afocal laser velocimeter projection less system
[NASA-CASE-LAR-12328-1] N80-12866

LASER FUSION
Electrostatics, small particles, and laser fusion targets
[UCRL-81537] N80-12834
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852

LASER GUIDANCE
Scanning afocal laser velocimeter projection less system
[NASA-CASE-LAR-12328-1] N80-12866

LASER HEATING
High temperature facility for atomic physics studies — test facilities for laser heating high temperature plasmas
[UCRL-13969] N80-12840

LASER OUTPUTS
Theoretical analysis of scattering of a laser beam from rough surfaces
[AD-A073129] N80-12871

LASER PLASMAS
Transient interactions of laser pulses with matter
N80-12213

LASER PUMPING
Intracavity quenching and dye kinetics of a nitrogen laser pumped dye laser
N80-12403
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404
Laser pump lamps
[AD-A072704] N80-12409

LASER RANGE FINDERS
Characterization of the Q-switched MOBLAS laser transmitter and its ranging performance relative to a PTM Q-switched system
[NASA-TM-80336] N80-12405

LASER SPECTROSCOPY
Laser-Raman spectroscopy
N80-12041

LASER TARGETS
Electrostatics, small particles, and laser fusion targets
[UCRL-81537] N80-12834

LASERS
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379

LATERAL STABILITY
AH-1G lateral flight performance test
[AD-A072868] N80-12088

LATEX
Preparation and characterization of latexes
N80-12115
Electroless [chemiphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141

LATTICE VIBRATIONS
An X-ray diffraction study of the thermal vibration of atoms in beta-tin
N80-12918
Lattice dynamics of hcp and bcc zirconium
N80-12930

LAUNCH VEHICLES
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032

LAUNCHING
The 19702A GSRS, missile number 336, round number B-19
[AD-A073110] N80-12702
The 19305AT GSRS, missiles number 1042, 1039, rounds number V-44, V-45
[AD-A073112] N80-12704
The 19305AT GSRS, missile number 1040, round number V-43 — meteorological data
[AD-A073188] N80-12705

LAW [JURISPRUDENCE]
A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] N80-12622

LEACHING
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963

LEAD [METAL]
Characterization of oxidation product films on lead in aqueous media by in situ Raman spectroscopy
N80-12133

LEADING EDGES
An improved Woodward's panel method for calculating leading-edge and side-edge suction forces at subsonic and supersonic speeds
[NASA-CR-3205] N80-12061
Impact damage on titanium leading edges from small soft body objects
[AD-A072705] N80-12095
Leading edge flutter of supercavitating hydrofoils
[AD-A073382] N80-12236

LEAST SQUARES METHOD
On the solution of a certain linear least squares fit problem
[AD-A072689] N80-12792

LENSES
Scanning afocal laser velocimeter projection less system
[NASA-CASE-LAR-12328-1] N80-12866

LEVITATION
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158

LIAPUNOV FUNCTIONS
On the existence of simple Liapunov Functions for linear retarded difference differential equations
[AD-A072762] N80-12784

LIBRARIES
Notes from the Second Department of Energy Library Workshop
[UCRL-81736] N80-12584

LIFE [DURABILITY]
Design, durability and low cost processing technology for composite fan exit guide vanes
[NASA-CR-159677] N80-12091
One-sided tolerance limits for a broad class of lifetime distributions with applications to data of limited accuracy
[AD-A072936] N80-12806

LIFE CYCLE COSTS
Validation of the Detroit Diesel Allison logistic support cost model [program OS 590]
[AD-A072670] N80-12094

LIFE SUPPORT SYSTEMS
Guiding the development of a controlled ecological life support system
[NASA-CR-162452] N80-12735
Evaluation of a ground based manned demonstration as a milestone in CELSS development
N80-12736
Development requirements for a successful ground based CELSS demonstration
N80-12737
Research recommendations
N80-12738

LIFT
Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 1: Data analysis
[NASA-CR-2214] N80-12054
Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 2: Test data
[NASA-CR-2215] N80-12055

LIFT DEVICES
Lifting surface divergence and control effectiveness
N80-12004

LIFTING BODIES
Lifting surface divergence and control effectiveness
N80-12004

LIGANDS
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833

LIGHT AIRCRAFT
Rotary balance data for a typical single-engine general aviation design for an angle-of-attack range of 6 degrees to 35 degrees, 3. Effect of wing leading-edge modifications, model A
[NASA-CR-3102] N80-12080

LIGHT BEAMS
Optical gyroscope system
[NASA-CASE-NPO-14258-1] N80-12383

LIGHT CURVE
Theoretical light and velocity curves for Cepheid variables
[LA-7598-MS] N80-12971

LIGHT EMISSION
Fanning of spark discharges
N80-12215

LIGHT SCATTERING
Effect of dimer dissociation on depolarized scattered light in dilute gases
N80-12864
The 360 deg light scattering photometer for single particle analysis
N80-12865
Theoretical analysis of scattering of a laser beam from rough surfaces
[AD-A073129] N80-12871

LIGNITE
Purification of waters discharged from Polish lignite mines
[PB-297466/5] N80-12636

LINE OF SIGHT COMMUNICATION
Cross polarization interference reduction techniques
[AD-A072748] N80-12266

LINE SPECTRA
The he I triplet line emission in class 1 Seyfert galaxies
N80-12972

LINEAR EQUATIONS
Solutions of Prandtl's boundary layer equations using linear programming and mappings
N80-12302
Introduction to numerical methods: Mathematical concepts and fundamental equations — numerical analysis of partial differential, linear, and nonlinear equations in fluid mechanics
N80-12366
Spline approximations for functional differential equations
[AD-A072763] N80-12785

LINEAR PROGRAMMING
A separable programming approach to the linear complementarity problem
[AD-A072928] N80-12767

LINEAR SYSTEMS
Modal representation and transfer function of linear dissipative structures
N80-12005
System theory as applied differential geometry — linear system
[NASA-CR-3209] N80-12776

Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear tokamak reactor
[LA-7359-P] N80-12889
LINEARITY
On the existence of simple Liapunov Functions for linear retarded difference differential equations
[AD-A072782] N80-12784
LININGS
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
LIPIDS
Phase transitions and statistical mechanics of lipid bilayer systems — using laser Raman spectroscopy
N80-12130
LIQUEFIED GASES
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
LIQUEFIED NATURAL GAS
Numerical modeling of LNG spill phenomena
[UCRL-82031] N80-12625
LIQUID HELIUM
Superfluid helium three: Some hydrodynamic measurements
N80-12131
LIQUID LITHIUM
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13930] N80-12852
Current status of fusion reactor blanket thermodynamics
[ANL-79-109] N80-12897
LIQUID METAL FAST BREEDER REACTORS
Engineering study of dry near-surface interim storage of fast flux test facility spent fuel
[HEDO-LD-66] N80-12858
LIQUID METALS
The magnetic susceptibility of the liquid bismuth-indium alloy system
N80-12126
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A075128] N80-12882
LIQUID NITROGEN
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019
LIQUID PHASES
The measurement of temperature instabilities and their effect on the liquid phase epitaxial growth of gallium arsenide
[ERL-0077-TR] N80-12931
LIQUID ROCKET PROPELLANTS
Investigation of critical burning of fuel droplets
[NASA-CR-159697] N80-12142
LIQUID-GAS MIXTURES
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-155-010] N80-12291
LIQUID-SOLID INTERFACES
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352
LIQUIDS
Numerical solutions to problems in liquid membrane electrochemistry
N80-12136
LITHIUM CHLORIDES
Investigations of the safety of Li/SOCl sub 2 batteries
[AD-A072862] N80-12555
LITHIUM COMPOUNDS
Effects of additives and moisture on the ionic conductivity of Li5MO4 [M = Al, Ga, Fe]
[SAND-79-0541C] N80-12939
LITHOSPHERE
The physical basis of climate
N80-12671
LOADS [FORCES]
Design and analysis of single cell balloons — stress analysis of high altitude balloons
[AD-A072828] N80-12068
Stresses in the neighborhood of loaded holes in wood with application to bolted joints
N80-12427
LOGIC DESIGN
AFAL simulation facility/capability manual. Volume 2: Executive summary. Computer aided design for microelectronics
[AD-A073383] N80-12283
Research study: Device technology STAR router user's guide — automated layout of large scale integration discretionary interconnection masks
[NASA-CR-161213] N80-12765
Generating correct programs from logic specifications
[AD-A073023] N80-12771
LONG RANGE WEATHER FORECASTING
Modeling of climatic changes and the problem of long-range weather forecasting
N80-12672
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
LONG TERM EFFECTS
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-230] N80-12166
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
A scenario of possible future climates: Natural and man-made
N80-12676
LOW DENSITY MATERIALS
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294
LOW TEMPERATURE
NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294
LOW TEMPERATURE TESTS
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916
LUBRICATING OILS
Oil whirl and critical instabilities in rotor-bearing systems
N80-12412
LUNAR EVOLUTION
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162930] N80-12979
LUNAR SEISMOGRAPHS
Analysis of lunar seismic signals: Determination of instrumental parameters and seismic velocity distribution
[NASA-CR-162603] N80-12980
LUXEMBOURG
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
LYMAN ALPHA RADIATION
On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973

M

MACH NUMBER
Application of supersonic linear theory and hypersonic impact methods to three nonslender hypersonic airplane concepts at Mach numbers from 1.10 to 2.86
[NASA-TP-1539] N80-12065
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — langley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
MAGELLANIC CLOUDS
Detection of a fast, intense and unusual gamma ray transient
[NASA-TM-80570] N80-12983
MAGNESIUM
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
MAGNESIUM GERMANATES
Deformation mechanisms in the olivine and spinel phases of magnesium germanate and applications to the earth's mantle
N80-12638
MAGNET COILS
Design and development of an ultra-thin solenoid for a high energy physics particle detector
[CONF-780952-28] N80-12288
MAGNETIC COILS
The experimental superconducting synchrotron [ESCAR]
[LBL-8211] N80-12836
MAGNETIC FIELDS
Turbulent destabilization and saturation of the universal drift mode in a sheared magnetic field — electron mobility in turbulent diffusion in a magnetic field
[ORNL/TM-6620] N80-12815
Polarized neutron diffraction in high magnetic fields
[CONF-780927-1] N80-12837
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
Tearing modes in a plasma with magnetic braiding
[PPPL-1561] N80-12884
The transport properties of dilute gases in applied fields
N80-12906
Studies of hopping and correlated hopping in p-type germanium by piezo-magneto-resistance measurements — effect of magnetic field and stress on germanium using a piezoelectric gage
N80-12914
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921
MAGNETIC MIRRORS
Multiple-mirror axial confinement using the fluid model
[LA-7580-MS] N80-12890
Superconducting magnets for mirror machines
[UCRL-81578] N80-12892
MAGNETIC PERMEABILITY
The magnetic susceptibility of the liquid bismuth-indium alloy system
N80-12126
Magnetic susceptibility of chromium and its alloys
N80-12155
MAGNETIC PROPERTIES
The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907
Magnetic and electronic properties of Nd-La and Co-La alloys
N80-12927
MAGNETIC RESONANCE
Spectroscopic and optically detected magnetic resonance studies of PO2[-] in potassium chloride — single crystals
N80-12127
MAGNETIC STORAGE
Large mass storage facility — for computers
[BNL-50900] N80-12753
MAGNETIC VARIATIONS
Tearing modes in a plasma with magnetic braiding
[PPPL-1561] N80-12884
MAGNETOHYDRODYNAMIC FLOW
Eigenvalue bounds and stability of conservative fluid and plasma flows
N80-12875
Multiple-mirror axial confinement using the fluid model
[LA-7580-MS] N80-12890
MAGNETOHYDRODYNAMIC GENERATORS
Results of duct area ratio changes in the NASA Lewis H2-O2 combustion MHD experiment
[NASA-TM-79308] N80-12881
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A075128] N80-12882
User's manual for the magnetohydrodynamic generator channel code, MHDCHN
[SAND-78-1260] N80-12894
MAGNETOHYDRODYNAMIC STABILITY
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12880
MAGNETOHYDRODYNAMICS
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899
MAGNETOSPHERE
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639
MAGNETS
Miniature cyclotron resonance ion source using small permanent magnet
[NASA-CASE-NPO-14324-1] N80-12851
MAINTAINABILITY
Developing maintainability for Tokamak fusion power systems, phase 2 report. Volume 2: Study results
[COO-4184-6-VOL-2] N80-12895
Reliability and maintainability analysis: A conceptual design model
[AD-A073120] N80-12949
MALFUNCTIONS
Control of ELT false alarms
[NASA-CR-162502] N80-12255
MAN ENVIRONMENT INTERACTIONS
Assessing man's impact on wetlands
[PB-298736/0] N80-12634
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12660
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
Climate at the millennium
N80-12666
Climatic change and human strategy
N80-12667
Global ecology and man
N80-12668
Human activities that effect climate — greenhouse effect
N80-12674
A scenario of possible future climates: Natural and man-made
N80-12676

Energy and climate: A review with emphasis on global interactions
N80-12677
Climatic variability and agriculture in the temperate regions
N80-12681
Climatic variability and agriculture in tropical moist regions
N80-12682
Climatic variability and agriculture in the semi-arid tropics
N80-12683
Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685
Climatic variability and land use: An African perspective
N80-12686
Climatic variability and forestry
N80-12687
Climatic variation and marine fisheries
N80-12688
Climate and economic activity
N80-12690
Climate and society: Lessons from recent events
N80-12691
Report on discussions held during the first week of the conference — world climate conference, Geneva, Jan. 1978
N80-12692
The declaration of the World Meteorological Conference: An appeal to nations
N80-12693
The influence of society on climate change and variability
N80-12696
Impacts of climate change and variability on society
N80-12697

MAN MACHINE SYSTEMS
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740
Building and exploiting user models
N80-12743

MANAGEMENT INFORMATION SYSTEMS
Better information management policies needed: A study of scientific and technical bibliographic services
[PB-298776/6] N80-12953

MANAGEMENT PLANNING
The future role of hydrogen fuel in an electrical society
[UTIAS-241] N80-12189
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] N80-12722
Suggested nuclear waste management radiological performance objectives
[NUREG-CR-0579] N80-12855
Reliability and maintainability analysis: A conceptual design model
[AD-A073120] N80-12949
A workforce and training profile for solid waste management and resource recovery
[PB-298612/3] N80-12968
AGARD bulletin technical programme, 1980
[AGARD-BULL-79/2] N80-12990

MANGANESE
An NMR study of the critical phenomena of MnF2 in a 75 KG field
N80-12929

MANIFOLDS [MATHEMATICS]
Some minimax principles with applications in nonlinear elliptic boundary value problems and global vortex flow
N80-12304
Finite group actions on simply-connected manifolds and CW complexes
N80-12778
Some aspects of the local and global theory of Pfaffian systems — cotangent bundle of a smooth manifold
N80-12780

MANIPULATORS
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/0] N80-12961

MANNED SPACE FLIGHT
Evaluation of a ground based manned demonstration as a milestone in CELSS development
N80-12736
Development requirements for a successful ground based CELSS demonstration
N80-12737
Research recommendations
N80-12738

MANPOWER
A workforce and training profile for solid waste management and resource recovery
[PB-298612/3] N80-12968

MAPPING
The effectiveness of two and three dimensional isarithmic surfaces in communicating magnitude, gradient, and pattern information
N80-12454
Making morphological maps of sand banks from aerial photographs
N80-12483
The determination of land usages for planning and cartography
N80-12517
Statistical representation of electrocardiographic body surface maps for feature identification data compression and classification
N80-12728

MARINE ENVIRONMENTS
Remote Sensing and Problems of the Hydrosphere
[NASA-CP-2109] N80-12718

MARINE METEOROLOGY
Proceedings of the annual climate diagnostics workshop — covering ocean related climate characteristics
[PB-298355/9] N80-12717

MARINE RESOURCES
Climatic variation and marine fisheries
N80-12688
Climatic variability, marine resources and offshore development
N80-12689

MARKET RESEARCH
Aircraft noise and the market for residential housing: Empirical results for seven selected airports
[PB-297681/9] N80-12635
Traffic model for commercial payloads in the Materials Experiment Assembly [MEA] — market research in commercial space processing
[NASA-CR-162456] N80-12958

MARKOV CHAINS
Statistical inference in Markov chains using the principal of minimum discrimination information
N80-12801

MARKOV PROCESSES
Stochastic games, oligopoly theory and competitive resource allocation
[AD-A073030] N80-12810

MARSHLANDS
Assessing man's impact on wetlands
[PB-298736/0] N80-12634
The first five years of coastal zone management
[PB-298780/7] N80-12723

MARYLAND
Baltimore applications project
[NASA-TM-80577] N80-12957

MASONRY
A mathematical model of masonry for predicting its linear seismic response characteristics
[PB-298266/8] N80-12241

MASS SPECTROSCOPY
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry — automatic test equipment
[FE-2537-9] N80-12193
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Mass spectrometry and fossil-energy conversion technology: A review
[FE-2537-7] N80-12198

MASS TRANSFER
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319
Transport phenomena in geological layers measurement of parameters
N80-12344

MATCHING
Matching algorithms — for finding optimum weight perfect matching in a graph
N80-12757

MATERIAL BALANCE
Statistical methods for evaluating sequential material balance data
[NUREG-CR-0683] N80-12809

MATERIALS HANDLING
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183
General and particular aspects of the particulate bed behaviour in the Post Accident Heat Removal situation for Liquid Metal Fast Breeder Reactors
N80-12349
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation — risk and radiation dosage
[UCRL-13917-VOL-1] N80-12856

MATHEMATICAL MODELS
Modal representation and transfer function of linear dissipative structures
N80-12005
Practical aspects of the calculation of structural vibrations
N80-12007
Calculation of transonic flows around wings
N80-12014
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032
Mixing length model for compressible turbulent flows in rough channels
N80-12044
A method for assessing the impact of wake vortices of USAF operations
[AD-A072967] N80-12072
Sea King Mk. 50 helicopter flight control system. A mathematical model of the AFCS [autostabiliser/autopilot mode]
[ARL/AERO-NOTE-387] N80-12099
Refinement of plume modeling in the infrared spectral region
[AD-A072725] N80-12113
Vacancy solution and two-dimensional gas models for gas mixture adsorption
N80-12140
Flame - a slow-flow combustion model
[AD-A072988] N80-12145
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190
A mathematical model of masonry for predicting its linear seismic response characteristics
[PB-298266/8] N80-12241
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
Second order modeling of turbulent flows
N80-12318
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319
Models of turbulent combustion for numerical predictions
N80-12324
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
Toward a comprehensive model for combustion in a direct injection stratified charge engine
[LA-UR-78-3223] N80-12418
OASIS: A general purpose mesh generator for finite element codes
[M-101] N80-12449
Geometrical analysis and rectification of LANDSAT MSS imagery: Comparison of different methods
N80-12457
A study in the determination of depth information from underwater acoustical scanners
N80-12458
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] N80-12533
The passive microwave remote sensing of soil moisture: The effect of tilled row structure
[NASA-TM-80589] N80-12537
Application of a method for comparing one-dimensional and two-dimensional models of a ground-water flow system
[UCRL-52541] N80-12545
A new system of equations for numerical weather forecasting
N80-12656
Numerical solution of a hyperbolic system of conservation laws for blood flow in the arterial tree
N80-12726
Modular theory of inverse systems
[NASA-CR-162491] N80-12782
Covariance sequence approximation with applications to spectrum analysis and digital filter design
[AD-A072884] N80-12783
Stochastic games, oligopoly theory and competitive resource allocation
[AD-A073030] N80-12810
Particle production in high-energy reactions and studies in a gauge model
N80-12848

MATRICES [CIRCUITS]
Reliability performances of systems with a switching matrix
N80-12217
Line Access Test System [LATS]
[AD-A072768] N80-12750

MATRICES [MATHEMATICS]
A program for calculating load coefficient matrices utilizing the force summation method, L218 [LOADS], Volume 1: Engineering and usage
[NASA-CR-2853] N80-12056
Equation modifying program, L219 [EQMOD]. Volume 1: Engineering and usage
[NASA-CR-2855] N80-12057
Spectral analysis of time series
[AD-A072921] N80-12788

MATRIX METHODS
Effect of constituent properties on composite strength
[UCRL-82051] N80-12124

MAXIMUM LIKELIHOOD ESTIMATES
Maximum likelihood estimation of label imperfections and its use in the identification of mislabeled patterns
[NASA-CR-160364] N80-12805

MAXWELL EQUATION
Oscillations and waves in anisotropic plasmas — are analyzed using Vlasov and Maxwell equations
N80-12878

MEASURING INSTRUMENTS
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195
MECHANICAL PROPERTIES
Mechanical property characterization of intraply hybrid composites
[NASA-TM-79306] N80-12120
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
MEDICAL ELECTRONICS
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730
MEDICAL SCIENCE
Automatic Data Processing Equipment [ADPE] acquisition plan for the medical sciences
[JSC-16075] N80-12746
MEMBRANES
Numerical solutions to problems in liquid membrane electrochemistry
N80-12136
Anion permselective membrane
[NASA-CR-159599] N80-12551
MESONS
Multiquark mesons
[ORO-3992-355] N80-12062
METAL BONDING
Replication technique for examining defects in the interface of a metal-to-glass ceramic bond
[GEPP-TIS-391] N80-12182
METAL FATIGUE
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
METAL FILMS
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157
METAL FINISHING
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing
[PB-298841/8] N80-12173
METAL HYDRIDES
Closed-cycle hydride engines
[SAND-78-2228] N80-12572
METAL OXIDE SEMICONDUCTORS
Method of making V-MOS field effect transistors
[NASA-CASE-GSC-12515-1] N80-12281
An introduction to the BANNING design automation system for shuttle microelectronic hardware development
[NASA-TM-80831] N80-12282
Metal-Nitride-Oxide-Semiconductor [MNOS] radiation characterization studies
[AD-A073637] N80-12287
METAL OXIDES
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
METAL PARTICLES
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
Studies of ultrafine metal particles
N80-12156
METAL SURFACES
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 2: Numerical evaluation
[AD-A072996] N80-12269
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 1: Theory
[AD-A072984] N80-12270
METAL WORKING
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
METALLIC GLASSES
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
METALLOIDS
Structure of some refractory transition metal metalloid glasses
[CALT-822-105] N80-12162
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
METALS
A rigorous theory for plane wave scattering from periodic trapezoidal metal surfaces
[AD-A072983] N80-12271
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941
Evaluation of a developmental heavy metals waste treatment system
[AD-A073131] N80-12959
METEOROLOGICAL PARAMETERS
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
The 1930ADT GSRS, missile no. 1031, round no. V-46
[AD-A073088] N80-12699
The 1681BC Lance, missile number 3396, round number 333 APL
[AD-A073109] N80-12701
The 1970ZA GSRS, missile number 336, round number B-19
[AD-A073110] N80-12702
The 1970ZA GSRS, missile number 302, round number B-20
[AD-A073111] N80-12703
The 1930SAT GSRS, missiles number 1042, 1039, rounds number V-44, V-45
[AD-A073112] N80-12704
The 1930SAT GSRS, missile number 1040, round number V-43 — meteorological data
[AD-A073108] N80-12705
The 1930AT GSRS, missiles number 1026, 1036, 1034, rounds number V-40, V-41, V-42
[AD-A073187] N80-12706
METEOROLOGY
SEASAT: Gulf of Alaska experiment. Surface truth data inventory
[PB-294616] N80-12546
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669
METHANE
The methanation reaction on ruthenium thin films: A mechanistic investigation
N80-12128
HYGAS process update
[CONF-781045-4] N80-12200
METHOD OF CHARACTERISTICS
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015
METHYL ALCOHOLS
Component relationships within two-phase gasoline/methanol/water systems
[BETC/RI-78/6] N80-12203
METHYL COMPOUNDS
Vibration-torsion interaction in the microwave spectrum of methyl malonaldehyde
N80-12831
MICROCHANNELS
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TP] N80-12891
MICROCOMPUTERS
Application of mini-and microcomputer techniques to problems in analytical chemistry
N80-12138
MICROELECTRONICS
Ultrapurification of reactive metals
[IS-M-167] N80-12168
AFAL simulation facility/capability manual. Volume 2: Executive summary. Computer aided design for microelectronics
[AD-A073383] N80-12283
Feasibility of electroplated gold for hybrid microcircuits
[BDX-613-2114] N80-12290
Solid state research
[AD-A073152] N80-12934
MICROPROCESSORS
Advanced digital TV system
[AD-A072917] N80-12274
Microprocessor-controlled, programmable ramp voltage generator
[SAND-78-8040] N80-12289
Design of a microprocessor based cardiotachometer
[AD-A073105] N80-12731
Error correction coding with NMIS microprocessors. Volume 1: Concepts
[AD-A072982] N80-12747
Error correction coding with NMOS microprocessors. Volume 2: A 6800-based 7, 3 Reed-Solomon Decoder
[AD-A073088] N80-12748
Line Access Test System [LATS]
[AD-A072766] N80-12750
MICROPULSATIONS
Micropulsations in the electric field near the plasmapause, observed by ISEE-1
[NASA-TM-80587] N80-12986
MICROSTRIP TRANSMISSION LINES
Characterization of thin film microstrip attenuators at microwave frequencies
[BDX-613-1857-REV] N80-12293
MICROSTRUCTURE
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
MICROWAVE ATTENUATION
Characterization of thin film microstrip attenuators at microwave frequencies
[BDX-613-1857-REV] N80-12293
MICROWAVE EMISSION
The passive microwave remote sensing of soil moisture: The effect of tilled row structure
[NASA-TM-80589] N80-12537
MICROWAVE FREQUENCIES
Some considerations about sky noise temperature at frequencies above 10GHz
N80-12229
Cross polarization interference reduction techniques
[AD-A072748] N80-12266
Characterization of thin film microstrip attenuators at microwave frequencies
[BDX-613-1857-REV] N80-12293
MICROWAVE PHOTOGRAPHY
Future remote sensing program of the DFVLR
N80-12470
MICROWAVE RADIOMETERS
Interim calibration report for the SMMR simulator
[NASA-TM-80564] N80-12534
MICROWAVE SPECTRA
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135
Microwave spectra and theoretical calculation of transient molecules — determining the ground state and dipole moment
N80-12828
Vibration-torsion interaction in the microwave spectrum of methyl malonaldehyde
N80-12831
MICROWAVES
Burning velocities of a solid propellant, via a microwave technique, at elevated pressures and pressurization rates
N80-12187
Communications technology in the 10 to 40 gigahertz frequency band
[PB-297221/4] N80-12275
MILITARY AIRCRAFT
The impact of global positioning system on guidance and controls systems design of military aircraft, volume I
[AGARD-AR-147-VOL-1] N80-12082
MILITARY AVIATION
Federal Aviation Act of 1958
N80-12954
MILITARY HELICOPTERS
AH-1G lateral flight performance test
[AD-A072866] N80-12088
MILITARY TECHNOLOGY
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768
Implications of an all-digital Navy technical information presentation system
[AD-A073095] N80-12951
MILLIMETER WAVES
Millimeter-wave mixers and detectors
[AD-A073591] N80-12284
MINERALS
Deformation mechanisms in the olivine and spinel phases of magnesium germanate and applications to the earth's mantle
N80-12638
MINIATURIZATION
Data acquisition and transmission from highly accelerated ballistic missiles of small and medium calibre — using miniaturized sensors and transmission systems
N80-12315
Research studies on neodymium pentaphosphate miniature lasers
[AD-A073140] N80-12408
Miniature cyclotron resonance ion source using small permanent magnet
[NASA-CASE-NPO-14324-1] N80-12851
MINICOMPUTERS
Application of mini-and microcomputer techniques to problems in analytical chemistry
N80-12138
Minicomputer applications in automated testing of electro-optical guidance systems
[AD-A073092] N80-12407
Block-adjustment programs for minicomputers
N80-12464
Notes from the Second Department of Energy Library Workshop
[UCRL-81736] N80-12584
High-speed graphics terminal interface for a PDP-11 minicomputer
[LA-7840-MS] N80-12754
MINIMAX TECHNIQUE
Some minimax principles with applications in nonlinear elliptic boundary value problems and global vortex flow
N80-12304
MINING
Automated longwall guidance and control systems, phase 1
[NASA-CR-161329] N80-12538
Automated longwall guidance and control systems, phase 2, part 2: Vertical control system [VCS]
[NASA-CR-161330] N80-12539
Automated longwall guidance and control systems, phase 2, part 2: RCS, FAS, and MCS
[NASA-CR-161331] N80-12540
Purification of waters discharged from Polish lignite mines
[PB-297466/5] N80-12636
MINNESOTA
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Min-

nents and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12530

MIRRORS
Radial diffusion of resonant particles in tandem mirrors — ionic diffusion of resonant particles in mirrors is derived from kinetic theory
[UCID-17992] N80-12902

MISSILE CONFIGURATIONS
The normal force on a cruciform missile at bank angles of a deg and 45 deg
N80-12037

MISSILE CONTROL
The 1930AT GSRS, missiles number 1026, 1036, 1034, rounds number V-40, V-41, V-42
[AD-A073187] N80-12706

MISSILE LAUNCHERS
A shock tube investigation of silo-launched vehicle aerodynamic flow asymmetries
[AD-A071811] N80-12110

MISSILE RANGES
The 1930SAT GSRS, missile number 1040, round number V-43 — meteorological data
[AD-A073188] N80-12705
The 1930AT GSRS, missiles number 1026, 1036, 1034, rounds number V-40, V-41, V-42
[AD-A073187] N80-12706

MISSILE SILOS
A shock tube investigation of silo-launched vehicle aerodynamic flow asymmetries
[AD-A071811] N80-12110

MISSILE STRUCTURES
Real time digital model of a rolling airframe
[AD-A073456] N80-12075

MISSILE TESTS
The 1930SAT GSRS, missile number 1040, round number V-43 — meteorological data
[AD-A073188] N80-12705
The 1930AT GSRS, missiles number 1026, 1036, 1034, rounds number V-40, V-41, V-42
[AD-A073187] N80-12706

MISSILE TRAJECTORIES
Restitution of missile trajectories by Kalman filtering-smoothing
N80-12023
Effect of horizontal and vertical side forces and moments on stability of a symmetric missile in ascending or descending flight
[AD-A072808] N80-12067

MISSILES
Preliminary design aerodynamic prediction methodology for missiles with nose bluntness
[AD-A073666] N80-12111
The 1930SAT GSRS, missiles number 1042, 1039, rounds number V-44, V-45
[AD-A073112] N80-12704

MISSOURI
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527

MIXING
Laser-Raman spectroscopy
N80-12041

MIXING CIRCUITS
Millimeter-wave mixers and detectors
[AD-A073591] N80-12284

MIXING LENGTH FLOW THEORY
Mixing length model for compressible turbulent flows in rough channels
N80-12044

MODULUS OF ELASTICITY
Effects of thermal spiking on graphite-epoxy composites
[AD-A072825] N80-12122

MOISTURE CONTENT
Investigation of moisture measurements, failure rate and leak rate and a study of moisture infusion
[PB-299172/7] N80-12299
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Collection and measurement efficiencies of the EWER cloud water meter for hydrometeors
[AD-A072827] N80-12700

MOLECULAR EXCITATION
Photochemistry and photophysics of formyl fluoride
N80-12134

MOLECULAR ORBITALS
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833

MOLECULAR OSCILLATIONS
Similarity in nozzle flows with vibrational nonequilibrium
N80-12043

MOLECULAR ROTATION
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135

MOLECULAR SPECTRA
Analysis of Coherent Anti-Stokes Raman Spectra: Determination of molecular parameters
N80-12829

MOLECULAR SPECTROSCOPY
Quasicontinuum physics — intramolecular dynamics in polyatomic molecules
[AD-A073117] N80-12144

MOLECULAR STRUCTURE
The crystal and molecular structure of trimethyltin chloride at 135 K, a highly volatile organotin polymer
[AD-A073641] N80-12180
The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907

MOLECULES
Microwave spectra and theoretical calculation of transient molecules — determining the ground state and dipole moment
N80-12828
Hydrostatic pressure effects on the motional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12910

MOMENTS OF INERTIA
Inertia calculation procedure for preliminary design
[AD-A072679] N80-12087

MOMENTUM
Momentum density measurements in Cu and diphasic Cu-Zn alloys with a multi-counter two-dimensional angular correlation of annihilation radiation apparatus
N80-12913

MOMENTUM TRANSFER
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319
Response of a Tokamak plasma to particle and momentum sources
[ORNL/TM-6575] N80-12901

MONSOONS
Laboratory modelling of oceanic response to monsoonal winds
[TR-15] N80-12659

MONTE CARLO METHOD
A conditional property of adaptive estimators — Monte Carlo method
[AD-A072991] N80-12790

MOTOR VEHICLES
Environmental aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12301

MOUNTAINS
Thermal images and climatic changes in regrouped vineyards on mountain slopes
N80-12489
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524

MULTILAYER INSULATION
Multiwall thermal protection system
[NASA-CASE-LAR-12620-1] N80-12117

MULTIPLIERS
Design of instantaneously companded delta modulators with M-bit memory
N80-12232

MULTIPROCESSING [COMPUTERS]
Multiprocessor architectures for supporting secure database management
N80-12742

MULTISPECTRAL BAND SCANNERS
Determination of noise equivalent reflectance for a multispectral scanner: A scanner sensitivity study
[NASA-TP-1575] N80-12399
Geometrical analysis and rectification of LANDSAT MSS imagery: Comparison of different methods
N80-12457
Texture analysis by means of synthetic impulse functions
N80-12466
Interpretation of water quality using remote sensing techniques
N80-12493
Geometrical restitution of multispectral scanning images
N80-12506
The multispectral scanner as an instrument for signature determinations
N80-12515
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12535
A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] N80-12622

MULTISPECTRAL PHOTOGRAPHY
On measurements from aircraft — conference, Hanover, 29-31 August 1977
[BMFT-FB-W-78-04] N80-12467
Determination of currents in coastal regions using multispectral scanning images
N80-12476
On the problem of the remote sensing of substances in water by multispectral scanning
N80-12478
Colored substance mixing experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Multispectral classification of sand bank region — Germany
N80-12481
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Interpretation of IR and MSS data for town areas
N80-12485
What are the advantages of multispectral classification? — for crop identification
N80-12501
Correspondance problems in polygonal segmented multispectral digital images
N80-12508
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] N80-12533

MULTIVARIATE STATISTICAL ANALYSIS
Target factor analysis of gas-chromatographic retention indices — multivariate statistical analysis of gas chromatography data for solutions and solvents
N80-12129
Guidelines for the use of structural versus regression analysis in geomorphic studies
[PB-296360/9] N80-12655
Spectral analysis of time series
[AD-A072921] N80-12788
Rank tests for restricted alternative problems in multivariate analysis
N80-12799
A special distribution result for bilinear forms
[AD-A072933] N80-12808

MUONS
Cascade of negative muons in atoms
[CALT-63-300] N80-12844

MUSCLES
Human muscle fiber types in power lifters, distance runners and untrained subjects: A histochemical and ultrastructural study
N80-12727

MYOCARDIUM
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730

N

NAPHTHALENE
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919
Coherence studies in the first electronic excited singlet state of solid naphthalene
N80-12920

NASA PROGRAMS
An overview of the NASA technology utilization program
N80-12397
Data requirements for oceanic processes in the open ocean, coastal zone, and cryosphere
[NASA-CR-162451] N80-12719

NASTRAN
NASTRAN processing at Johnson Space Center
[NASA-CR-160382] N80-12440

NATURAL GAS
Fuel choice and aggregate energy demand in the commercial sector — electricity, natural gas, and fuel oil
[ORNL/CON-27] N80-12580

NATURAL LANGUAGE [COMPUTERS]
Skimming stories in real time: An experiment in integrated understanding
N80-12763

NAVIER-STOKES EQUATION
Computation of discrete hole film cooling flow using the Navier-Stokes equations — gas turbine blades
[AD-A073057] N80-12096
Computational aspects of viscous flows — numerical analysis of viscous flow and the relationship of the boundary layer equations to the navier-stokes equation
N80-12371

NEAR FIELDS
Electromagnetic interference [EMI] radiative measurements for automotive applications
[PB-298605/7] N80-12276

NEODYMIUM
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927

NEODYMIUM COMPOUNDS
Research studies on neodymium pentaphosphate miniature lasers
[AD-A073140] N80-12408

NEODYMIUM LASERS
Characterization of the Q-switched MOBLAS laser transmitter and its ranging performance relative to a PTM Q-switched system
[NASA-TM-80336] N80-12405

Research studies on neodymium pentaphosphate miniature lasers
[AD-A073140] N80-12408
NETHERLANDS
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
NETWORK ANALYSIS
Traffic simulation in a telephone network via nonlinear with preassigned and demand assigned circuits
N80-12221
Line Access Test System [LATS]
[AD-A072768] N80-12750
NEUTRON IRRADIATION
Safety aspects of activation products in a compact Tokamak Fusion Power Plant
[PNL-2823] N80-12093
NEUTRON SCATTERING
Polarized neutron diffraction in high magnetic fields
[CONF-780927-1] N80-12837
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
NEW ENGLAND [US]
National Energy Act of 1978: A regional assessment
[PB-296479/9] N80-12615
NEW MEXICO
Evaluation of salt beds in New Mexico as a geologic repository for nuclear waste
[SAND-78-2086C] N80-12853
NICKEL
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157
Weldability of electroformed nickel
[Y-2171] N80-12172
NICKEL ALLOYS
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916
NIGER
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
NIGERIA
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
NIGHT
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Catchment, north west of London, U.K.
[E80-10006] N80-12522
NIOBATES
Preparation and comparison of the photoelectric properties of $Sr2Nb2O7$ and $Ba0.5Sr0.5Nb2O6$
[AD-A073192] N80-12935
NITRATES
Studies on the collection and analysis of nitrite and ammonium ions in atmospheric particulate matter
N80-12618
NITRIC ACID
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121
NITRIDES
Metal-Nitride-Oxide-Semiconductor [MNOS] radiation characterization studies
[AD-A073637] N80-12287
NITROGEN DIOXIDE
Detonation of nitromethane-Al-NO2 mixtures
N80-12206
NITROGEN IONS
Experimental study of low-energy charge transfer in nitrogen
[NASA-TM-80156] N80-12398
NITROGEN LASERS
Intracavity quenching and dye kinetics of a nitrogen laser pumped dye laser
N80-12403
NITROGEN OXIDES
Predictions of the effects on the stratosphere of changes in the oxides of nitrogen
[UCRL-82553] N80-12651
NITROMETHANE
Detonation of nitromethane-Al-NO2 mixtures
N80-12206
NITROUS OXIDES
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
NOISE GENERATORS
Aeroacoustic characterization of free jets
N80-12025
NOISE PREDICTION [AIRCRAFT]
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818
Near-field noise prediction for aircraft in cruising flight: Methods manual — laminar flow control noise effects analysis
[NASA-CR-159105] N80-12819
NOISE PROPAGATION
Shock tube research looking at the origin of the Machwaves inside and outside supersonic jets
N80-12211
Time-dependent difference theory for noise propagation in a two-dimensional duct — of a turbofan engine
[NASA-TM-79298] N80-12822
NOISE REDUCTION
Aviation Safety and Noise Abatement Act of 1979
[S-REPT-96-52] N80-12621
An experimental study of acoustic propagation and attenuation in a circular annular duct with a variable cross-sectional area
N80-12816
Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820
NOISE TEMPERATURE
Some considerations about sky noise temperature at frequencies above 10GHz
N80-12229
NONDESTRUCTIVE TESTS
A new method of electric measurement of crack length
N80-12018
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179
Improved capabilities to detect incipient bearing failures
[AD-A073123] N80-12416
Electrical overstress program
[AD-A073148] N80-12422
Optimization of computer automated ultrasonic inspection system
[AD-A072677] N80-12423
NONLINEAR EQUATIONS
Introduction to numerical methods: Mathematical concepts and fundamental equations — numerical analysis of partial differential, linear, and nonlinear equations in fluid mechanics
N80-12366
NONLINEAR SYSTEMS
Development of stability methods for application to nonlinear aerodynamic optimization
N80-12052
NONUNIFORMITY
Pathological cases in turbulent field and spectral approach
N80-12321
NORMAL DENSITY FUNCTIONS
Effects of categorization on relationships in bivariate distributions and applications to rating scales
N80-12796
Towards reconstruction of an un-paired random sample — from a bivariate normal distribution
N80-12798
A comparative study of nonparametric methods in the randomized block design under ordered alternatives
N80-12804
NORTH AMERICA
Tide tables 1980. High and low water predictions. East Coast of North and South America including Greenland
[PB-298726/1] N80-12725
NOZZLE FLOW
Similarity in nozzle flows with vibrational nonequilibrium
N80-12043
Time-dependent difference theory for noise propagation in a two-dimensional duct — of a turbofan engine
[NASA-TM-79298] N80-12822
A time dependent difference theory for sound propagation in ducts with flow — characteristic of inlet and exhaust ducts of turbofan engines
[NASA-TM-79302] N80-12823
NUCLEAR CAPTURE
Complementarity between neutron capture and heavy-ion reactions in nuclear structure studies
[LA-UR-78-2432] N80-12863
NUCLEAR FISSION
World Energy Data System [WENDS]. Volume II: Nuclear fusion program summaries
[ANL-PMS-79-2-VOL-II] N80-12562
Photofission and electrofission
[UCRL-81596] N80-12942
NUCLEAR FUEL ELEMENTS
Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation
[TFBP-TR-292] N80-12164
NUCLEAR FUSION
United States magnetic fusion energy program
[DOE/ET-0072] N80-12583
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899
Search for fusion power
[UCRL-81890] N80-12900
NUCLEAR MAGNETIC RESONANCE
NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165
FT-NMR determination of silane hydrogen
[MHSMP-78-45] N80-12181
Applications of solid state nuclear magnetic resonance techniques to the study of coals and polymers
[IS-T-822] N80-12838
An NMR study of the critical phenomena of MnF2 in a 75 KG field
N80-12929
NUCLEAR MODELS
Independent particle aspects of nuclear dynamics
[LBL-4181] N80-12861
NUCLEAR STRUCTURE
Pion-nucleus scattering using finite binding potentials
N80-12850
Complementarity between neutron capture and heavy-ion reactions in nuclear structure studies
[LA-UR-78-2432] N80-12863
NUCLEATION
The role of coalescence nuclei in warm rain initiation
[PB-298536/2] N80-12654
NUCLEI [NUCLEAR PHYSICS]
Directional distributions of beta-rays emitted from oriented nuclei
N80-12949
NUCLEON-NUCLEON INTERACTIONS
Parity violation in the scattering of 15 MeV protons by hydrogen
[LA-UR-78-2875] N80-12835
NUCLEON-NUCLEON SCATTERING
Pion-nucleus scattering using finite binding potentials
N80-12850
NUMERICAL ANALYSIS
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
Curvature effects on the behavior of laminar boundary layers
N80-12045
Large deflection analysis of portal frames
[PB-298741/0] N80-12248
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 2: Numerical evaluation
[AD-A072990] N80-12269
Computational Fluid Dynamics
[VKI-LEC-SER-1979-6] N80-12358
Application of Numerical methods to Flow calculations in turbomachines
[VKI-LEC-SER-1979-7] N80-12365
Introduction to numerical methods: Mathematical concepts and fundamental equations — numerical analysis of partial differential, linear, and nonlinear equations in fluid mechanics
N80-12366
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
Computational aspects of viscous flows — numerical analysis of viscous flow and the relationship of the boundary layer equations to the navier-stokes equation
N80-12371
Numerical simulation of collapsing turbulent wakes: Comparison of turbulence closures and numerical schemes
[AD-A072143] N80-12378
Simplified solution algorithms for fluid flow problems
[LA-UR-78-2813] N80-12381
Thermal stresses in non-homogeneous shells of revolution: Theory and analysis
[IIT-B/CE-79-2] N80-12437
Numerical modeling of LNG spill phenomena
[UCRL-82031] N80-12625
NUMERICAL CONTROL
A communications trade-off study for computerized traffic control. Volume 2: Appendixes
[PB-298844/2] N80-12967
NUMERICAL FLOW VISUALIZATION
Computation of discrete hole film cooling flow using the Navier-Stokes equations — gas turbine blades
[AD-A073057] N80-12096
Direct numerical simulation of turbulence
N80-12320
Application of a method for comparing one-dimensional and two-dimensional models of a ground-water flow system
[UCRL-52541] N80-12545
NUMERICAL INTEGRATION
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
NUMERICAL STABILITY
Order of accuracy and boundary conditions for large scale time dependent partial differential equations
N80-12361
NUMERICAL WEATHER FORECASTING
A new system of equations for numerical weather forecasting
N80-12656

Some results of climate experiments with numerical results
N80-12675
Aids for forecasting minimum temperature in the Wenatchee frost district
[PB-298339/3] N80-12713
NUTRITIONAL REQUIREMENTS
Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops
N80-12497
NYLON [TRADEMARK]
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179

O

OBLIQUE WINGS
Wind tunnel investigation of an oblique wing transport model at mach numbers between 0.6 and 1.4
[NASA-CR-137697] N80-12059
OBSERVATION AIRCRAFT
Aims and tasks of the aircraft test program
N80-12468
OCEAN BOTTOM
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827
OCEAN CURRENTS
Laboratory modelling of oceanic response to monsoonal winds
[TR-15] N80-12659
General effects of current and wind-speed variations on shortrange acoustic transmission in cyclonic eddies
[AD-A072765] N80-12826
OCEAN MODELS
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Numerical simulation of collapsing turbulent wakes: Comparison of turbulence closures and numerical schemes
[AD-A072143] N80-12378
Laboratory modelling of oceanic response to monsoonal winds
[TR-15] N80-12659
Analysis of coastal upwelling and the production of a biomass
[NASA-TM-78614] N80-12720
An analysis of longshore currents and associated sediment transport in the surf zone
[PB-298291/6] N80-12724
OCEAN THERMAL ENERGY CONVERSION
Foam solar sea power: A physical investigation
N80-12548
Thermoelectric ocean thermal energy conversion
[SERI/TP-35-254] N80-12564
Ocean Thermal Energy Conversion [OTEC] platform configuration and integration, executive summary
[DOE/ET-4064-1] N80-12600
OCEANOGRAPHY
SEASAT: Gulf of Alaska experiment. Surface truth data inventory
[PB-296616] N80-12546
OFFSHORE ENERGY SOURCES
Climatic variability, marine resources and offshore development
N80-12689
OFFSHORE PLATFORMS
Ocean Thermal Energy Conversion [OTEC] platform configuration and integration, executive summary
[DOE/ET-4064-1] N80-12600
OIL EXPLORATION
Overview of in situ oil shale technology and recent advances in true in situ retort modeling
[SAND-78-2367C] N80-12543
OIL POLLUTION
A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] N80-12622
OIL RECOVERY
Naturally occuring carbon dioxide sources in the United States. A geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery
[FE-2025-38] N80-12624
ON-LINE PROGRAMMING
Application of data acquisition systems for on-line definition and control of wind tunnel shape
N80-12356
ONE DIMENSIONAL FLOW
Two-dimensional mesh adjustment algorithm
[AD-A073060] N80-12787
OPERATING SYSTEMS [COMPUTERS]
Background storage management in operating systems for communications computers
[ESA-TT-500] N80-12755
OPTICAL EMISSION SPECTROSCOPY
Spectroscopic and optically detected magnetic resonance studies of PO2[-] in potassium chloride — single crystals
N80-12127
OPTICAL EQUIPMENT
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
OPTICAL GYROSCOPES
Optical gyroscope system
[NASA-CASE-NPO-14258-1] N80-12383
OPTICAL MEASURING INSTRUMENTS
Preliminary applications and evaluation results. Linscope: Proceedings of the Linscope Conference
[NASA-CP-2112] N80-12384
The Linscope concept
N80-12385
Future progress in the development of the Linscope
N80-12386
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
X-ray source characteristics and detection efficiencies of prototype Linscopes
N80-12388
Some contemplated improvements to the prototype Linscope
N80-12389
A comparison of the Linscope with other X-ray imaging systems
N80-12390
Orthopedic evaluation
N80-12391
Dental research: Preliminary observations and projections
N80-12392
Dosimetric considerations in dental applications
N80-12393
Maxillo: Facial diagnosis
N80-12394
Pediatrics
N80-12395
Podiatry
N80-12396
OPTICAL MEMORY [DATA STORAGE]
Optical mass memory investigations. Volume 3: Considerations for the development of a DIGIMEM archival optical mass storage system
[NASA-CR-162465] N80-12745
OPTICAL PROPERTIES
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-12020
A study of the optical and transport properties of the ternary semiconducting compounds AlxGa1-xAs high pressure
N80-12911
OPTICAL PUMPING
Laser pump lamps
[AD-A072704] N80-12409
OPTICAL RADAR
Accuracy of parameter estimates for closely spaced optical targets
[AD-A073093] N80-12870
OPTICAL RESONATORS
Shallow bulk acoustic waves
[AD-A072742] N80-12825
OPTICAL TRACKING
Single pilot scanning behavior in simulated instrument flight
[NASA-TM-80178] N80-12732
OPTICAL WAVEGUIDES
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
OPTIMIZATION
Development of stability methods for application to nonlinear aeroelastic optimization
N80-12052
ORBIT CALCULATION
An intermediate-averaged theory for high altitude orbits
[AD-A073094] N80-12104
ORBIT DECAY
Orbit decay analysis of STS upper stage boosters
[NASA-CR-160385] N80-12103
Analytic theory of orbit contraction and ballistic entry into planetary atmospheres
N80-12978
ORBITAL MECHANICS
Orbit decay analysis of STS upper stage boosters
[NASA-CR-160385] N80-12103
An intermediate-averaged theory for high altitude orbits
[AD-A073094] N80-12104
Analytic theory of orbit contraction and ballistic entry into planetary atmospheres
N80-12978
ORGANIC MATERIALS
Status of the PEATGAS process
[CONF-781045-3] N80-12199
ORTHOPEDICS
Orthopedic evaluation
N80-12391
ORTHOTROPIC SHELLS
Thermal stresses in non-homogeneous shells of revolution: Theory and analysis
[IIT-B/CE-79-2] N80-12437
OSCILLATING FLOW
Oscillatory flow birefringence measurements of block copolymers in solution
N80-12174
OSCILLATIONS
The method of weighted residuals in the time domain applied to nonlinear vibrations
[NAL-TR-564T] N80-12435
OVERVOLTAGE
Electrical overstress program
[AD-A073146] N80-12422
OXIDATION
Characterization of oxidation product films on lead in aqueous media by in situ Raman spectroscopy
N80-12133
Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation
[TFBP-TR-297] N80-12364
OXIDE FILMS
Characterization of oxidation product films on lead in aqueous media by in situ Raman spectroscopy
N80-12133
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
OXIDIZERS
Kinetic spectroscopy of metal atom/oxidizer chemiluminescent reactions for laser applications
[AD-A073082] N80-12411
OXYGEN
Results of duct area ratio changes in the NASA Lewis H2-O2 combustion MHD experiment
[NASA-TM-79308] N80-12881

P

P-N JUNCTIONS
Very shallow p-n junctions with boron-rich layers and applications as high efficiency p+/n photovoltaic junctions
N80-12915
PACIFIC OCEAN
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12535
PACKING DENSITY
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352
PADE APPROXIMATION
Variational Pade approximants applied to the three- and four-body problem
N80-12944
PAINTS
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185
PALEONTOLOGY
Climates of past geological epochs — paleogeography
N80-12670
PARABOLIC ANTENNAS
Low sidelobe level low-cost earth station antennas for the 12 GHz broadcasting satellite service
[NASA-CR-159703] N80-12259
PARABOLIC REFLECTORS
Analysis and synthesis of an elliptical paraboloid offset reflector antenna. An elliptically shaped beam antenna
N80-12225
Analytical and graphical methods for the design of an elliptically shaped beam antenna with elliptical paraboloid reflector
N80-12226
An elliptically shaped beam antenna
N80-12227
PARALLEL PROCESSING [COMPUTERS]
The design and analysis of a parallel processing language
N80-12761
PARALLEL PROGRAMMING
The design and analysis of a parallel processing language
N80-12761
PARAMETERIZATION
Improved estimations under restricted parameters spaces
N80-12802
Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923
PARTIAL DIFFERENTIAL EQUATIONS
Numerical methods for hyperbolic partial differential equations
N80-12359
Order of accuracy and boundary conditions for large scale time dependent partial differential equations
N80-12361
On some problems in two and single phase flows
N80-12363
Introduction to numerical methods: Mathematical concepts and fundamental equations — numerical analysis of partial differential, linear, and nonlinear equations in fluid mechanics
N80-12366

PARTICLE ACCELERATION
Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12834
On the acceleration of energetic protons by interplanetary shock waves
N80-12975

PARTICLE ACCELERATORS
Operation of a high-current xenon source
[LBL-8879] N80-12349
High energy accelerator and colliding beam user group
[ORO-2504-277] N80-12857

PARTICLE BEAMS
The experimental superconducting synchrotron [ESCAR]
[LBL-8211] N80-12836
Directional distributions of beta-rays emitted from oriented nuclei
N80-12949
High energy accelerator and colliding beam user group
[ORO-2504-277] N80-12857

PARTICLE DIFFUSION
Studies of ultrafine metal particles
N80-12156

PARTICLE ENERGY
Ground state energy of molecular trimers
N80-12832

PARTICLE MOTION
Modelling and simulation of a moving-bed heat-exchange process
N80-12348

PARTICLE PRODUCTION
Particle production in high-energy reactions and studies in a gauge model
N80-12848

PARTICLE SIZE DISTRIBUTION
Studies of ultrafine metal particles
N80-12156
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352
Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/8] N80-12402
Laboratory investigations of cloud forming nuclei and aerosol particles from supersonized burns of space shuttle propellant
[NASA-CR-160356] N80-12664

PARTICLE THEORY
Research program in elementary particle theory -- study of particle theory in astrophysics, electromagnetic interactions, and quantum theory
[ORO-3992-362] N80-12842
Subconstituent particle aspects of nuclear dynamics
[LBL-8181] N80-12861

PARTICLE TRACKS
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921

PARTICLE TRAJECTORIES
Directional distributions of beta-rays emitted from oriented nuclei
N80-12849

PARTICLES
Electrostatics, small particles, and laser fusion targets
[UCRL-81537] N80-12834
The 360 deg light scattering photometer for single particle analysis
N80-12865

PASSIVITY
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157

PATTERN RECOGNITION
Texture analysis by means of synthetic impulse functions
N80-12466
Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12488
Classification of agricultural land with the aid of remote sensing methods
N80-12495
Aerial photography of agricultural farming land
N80-12496
Texture analysis as a recognition parameter for different types of forests
N80-12498
Digital processing procedure for texture analysis with remote sensing data
N80-12505
A study of the tolerance block approach to special stratification -- winter wheat in Kansas
[E80-10027] N80-12529
Maximum likelihood estimation of label imperfections and its use in the identification of misclassified patterns
[NASA-CR-160364] N80-12805
Optical fringe analysis techniques, volume 1
[AD-A072274] N80-12968

PAVEMENTS
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185
Relationship of asphalt cement properties to pavement durability
[PB-298833/5] N80-12245
Failure and repair of continuously reinforced concrete pavement
[PB-298832/7] N80-12246
Performance of continuously reinforced concrete pavement in Illinois
[PB-298695/7] N80-12249

PDP 11 COMPUTER
IMS 11: An Information on Management System for the PDP 11 computer
[PB-298731/1] N80-12756

PENALTY FUNCTION
A penalty function approach for the nonlinear finite element analysis of thin shells
N80-12432

PERCOLATION
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919

PERFORMANCE PREDICTION
Engine component improvement program: Performance improvement -- fuel consumption
[NASA-TM-79306] N80-12092

PERFORMANCE TESTS
AH-1G lateral flight performance test
[AD-A072040] N80-12088

PERIODIC VARIATIONS
Homogenization of static thermoelastic properties of media with periodic structures
N80-12028
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669

PERMEABILITY
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183
An evapo-transmission method for determining relative permeability of concrete
[PB-298323/7] N80-12251
Anion permselective membrane
[NASA-CR-159599] N80-12551

PERTURBATION THEORY
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
Perturbed bifurcation theory for plane Poiseuille flow
N80-12305
Perturbative applications of quantum chromodynamics
N80-12945
Semiclassical statistical mechanics
[LBL-8095] N80-12947

PETN
High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials -- PETN and HNS in explosive components
[SAND-79-0935C] N80-12150

PFAFF EQUATION
Some aspects of the local and global theory of Pfaffian systems -- cotangent bundle of a smooth manifold
N80-12780

PHASE DIAGRAMS
Component relationships within two-phase gasoline/methanol/water systems
[BETC/RI-78/6] N80-12203

PHASE SHIFT KEYING
Performance and impairments in a QPSK satellite to ground link
N80-12218

PHASE TRANSFORMATIONS
Phase transitions and statistical mechanics of lipid bilayers systems -- using laser Raman spectroscopy
N80-12130

PHENOLOGY
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499

PHONONS
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919

PHOSPHORUS
X-ray diffraction study of the alloy system $InP_{x}As_{1-x}$
N80-12926

PHOSPHORUS OXIDES
Spectroscopic and optically detected magnetic resonance studies of PO_4^{4-} in potassium chloride -- single crystals
N80-12127

PHOTOCATHODES
Some contemplated improvements to the prototype Lixiscope
N80-12389

PHOTOCHEMICAL REACTIONS
Photochemistry and photolysis of furoyl fluoride
N80-12134
Synthesis and photophysical properties of a fluorescent polyamide series and their monomer analogs: Novel intramolecular excimer and exciplex interactions
N80-12175

PHOTOELASTICITY
Development and application of methods of experimental mechanics -- photoelastic and viscoelastic stress analysis
[AD-A072836] N80-12441

PHOTOELECTRIC MATERIALS
Preparation and comparison of the photoelectric properties of $Sr_2Nb_2O_7$ and $Ba_{0.95}Sr_{0.5}Nb_2O_6$
[AD-A073192] N80-12935

PHOTOELECTROCHEMICAL DEVICES
Photoelectrochemical conversion of optical energy to electricity and fuels
[AD-A072861] N80-12556

PHOTOELECTRON SPECTROSCOPY
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833
Collective effects, relaxation and localization of hole levels in atoms, molecules, solids, and adsorbates
[BNL-26068] N80-12940

PHOTOGRAMMETRY
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Auto- and cross-correlation of image coordinates
N80-12456
Bundle adjustment with field and self calibration: Recent results
N80-12461
Progress in photogrammetric point determination by compensation of systematic errors and detection of gross errors
N80-12462
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
Block-adjustment programs for minicomputers
N80-12464
Automatic data acquisition for digital height model
N80-12465
Interactive correction of classified photographs
N80-12503

PHOTOGRAPHIC FILM
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401

PHOTOGRAPHIC PROCESSING
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401

PHOTOINTERPRETATION
Making morphological maps of sand banks from aerial photographs
N80-12483

PHOTOIONIZATION
Studies of electron correlation in the photoionization process
[LBL-8944] N80-12945

PHOTOLYSIS
Preparation and comparison of the photoelectric properties of $Sr_2Nb_2O_7$ and $Ba_{0.95}Sr_{0.5}Nb_2O_6$
[AD-A073192] N80-12935

PHOTOMAPPING
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455

PHOTOMETERS
The 360 deg light scattering photometer for single particle analysis
N80-12865

PHOTOMULTIPLIER TUBES
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TF] N80-12991

PHOTONS
Photofission and electrofission
[UCRL-81596] N80-12942

PHOTOSENSITIVITY
Determination of noise equivalent reflectance for a multispectral scanner: A scanner sensitivity study
[NASA-TP-1575] N80-12799

PHOTOSYNTHESIS
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3548-01] N80-12587

PHOTOVOLTAIC CELLS
A photovoltaic power system in the remote African village of Tangaye, Upper Volta
[NASA-TM-79318] N80-12552
Batteries for specific solar applications
[SAND-79-1428C] N80-12559
Mead, Nebraska, 25-kW photovoltaic power system
[COO-4094-10] N80-12592
Very shallow p-n junctions with boron-rich layers and applications as high efficiency p+/n photovoltaic junctions
N80-12915

PHOTOVOLTAIC EFFECT
Photoelectrochemical conversion of optical energy to electricity and fuels
[AD-A072861] N80-12556

PHYSICAL OPTICS
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 1: Theory
[AD-A072946] N80-12270
PHYSIOLOGICAL EFFECTS
Future progress in the development of the Lixiscope
N80-12386
PHYSIOLOGICAL TESTS
Statistical representation of electrocardiographic body surface maps for feature identification data compression and classification
N80-12728
PIEZOELECTRIC CRYSTALS
Shallow bulk acoustic waves
[AD-A072742] N80-12825
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072764] N80-12936
PIEZOELECTRIC GAGES
Studies of hopping and correlated hopping in p-type germanium by piezo-magneto-resistance measurements — effect of magnetic field and stress on germanium using a piezoelectric gage
N80-12914
PIEZOELECTRIC TRANSDUCERS
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730
PILOT PERFORMANCE
Single pilot scanning behavior in simulated instrument flight
[NASA-TM-80178] N80-12732
PILOT PLANTS
HYGAS process update
[CONF-781045-4] N80-12200
PIONS
Pion-nucleus scattering using finite binding potentials
N80-12850
PIPE FLOW
Viscoelastic radial flow between parallel disks
N80-12309
PIPELINES
Seismic vulnerability, behavior and design of buried pipelines, phase I
[PB-298269/2] N80-12240
PIPES [TUBES]
Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143
Performance of buried flexible conduits — highways
[PB-298224/7] N80-12250
PISTON ENGINES
Toward a comprehensive model for combustion in a direct injection stratified charge engine
[LA-UR-78-3223] N80-12418
PITOT TUBES
Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-intakes
N80-12038
PLAINS
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
PLANAR STRUCTURES
A rigorous theory for plane wave scattering from periodic trapezoidal metal surfaces
[AD-A072983] N80-12271
PLANE WAVES
A rigorous theory for plane wave scattering from periodic trapezoidal metal surfaces
[AD-A072983] N80-12271
PLANETARY EVOLUTION
A global geochemical model for the evolution of the mantle
[NASA-CR-162602] N80-12644
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162900] N80-12979
PLANNING
Climatic change and human strategy
N80-12667
PLASMA CONTROL
Multiple-mirror axial confinement using the fluid model
[LA-7580-MS] N80-12890
Superconducting magnets for mirror machines
[UCRL-81578] N80-12892
Thermal-hydraulic considerations in magnetically confined fusion reactors
[GA-A-15365] N80-12896
Thermonuclear burn in wall-confined plasmas
[COO-2456-60] N80-12905
PLASMA DIAGNOSTICS
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TP] N80-12891
PLASMA DIFFUSION
Convective cells and their relationship to vortex diffusion in the Wisconsin levitated octupole — study of plasma potential structure or vortices to determine plasma diffusion
N80-12877
PLASMA JETS
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12880
PLASMA LOSS
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12880
PLASMA OSCILLATIONS
Oscillations and waves in anisotropic plasmas — are analyzed using Vlasov and Maxwell equations
N80-12878
PLASMA PHYSICS
Convective cells and their relationship to vortex diffusion in the Wisconsin levitated octupole — study of plasma potential structure or vortices to determine plasma diffusion
N80-12877
Magnetic fusion theory effort — bibliography
[DOE/ET-0099] N80-12899
Statistical mechanics of reacting dense plasmas
[UCRL-81936] N80-12903
PLASMA PINCH
Experiments on the ZT-S reversed-field pinch, August - December 1978
[LA-7862-MS] N80-12885
Transport and radiation studies of belt pinches and high-beta Tokamaks
[SAI-78-964-LJ] N80-12887
PLASMA POTENTIALS
Convective cells and their relationship to vortex diffusion in the Wisconsin levitated octupole — study of plasma potential structure or vortices to determine plasma diffusion
N80-12877
PLASMA RADIATION
Transport and radiation studies of belt pinches and high-beta Tokamaks
[SAI-78-964-LJ] N80-12887
PLASMA SHEATHS
Specification of the natural plasma environment at geosynchronous orbit
[AD-A073160] N80-12883
PLASMA TURBULENCE
Turbulence measurements by digital spectral estimation in the chmically heated Protocleo Torsatron — digital techniques of signal processing to measure plasma turbulence
N80-12879
PLASMA WAVES
Oscillations and waves in anisotropic plasmas — are analyzed using Vlasov and Maxwell equations
N80-12878
PLASMA-ELECTROMAGNETIC INTERACTION
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639
PLASMA-PARTICLE INTERACTIONS
Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear solenoidal reactor
[LA-7359-P] N80-12889
Response of a Tokamak plasma to particle and momentum sources
[ORNL/TM-6575] N80-12901
PLASMAPAUSE
Intense electrostatic waves near the upper hybrid resonance frequency
N80-12640
Micropulsations in the electric field near the plasmapause, observed by ISEE-1
[NASA-TM-80580] N80-12986
PLASMAS [PHYSICS]
Turbulence measurements by digital spectral estimation in the chmically heated Protocleo Torsatron — digital techniques of signal processing to measure plasma turbulence
N80-12879
Tearing modes in a plasma with magnetic braiding
[PPPL-1561] N80-12884
Thermonuclear burn in wall-confined plasmas
[COO-2456-60] N80-12905
PLASTIC DEFORMATION
Small-scale yielding at the tip of a through-crack in a shell
[AD-A072832] N80-12442
Near-tip plastic deformations in dynamic fracture mechanics
[AD-A072833] N80-12443
PLASTIC PROPERTIES
Rate complementary energy principles finite strain plasticity problems and finite elements
[AD-A072970] N80-12446
PLASTICS
Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143
PLATEAUS
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
PLOTTERS
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
PLUTONIUM OXIDES
General purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7601-PR] N80-12854
POGO EFFECTS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-566] N80-12029
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032
POINT DEFECTS
Stored energy in the I sub b subtage of aluminum
N80-12154
POINTS [MATHEMATICS]
Linear extremal problems in the class of univalent functions
N80-12779
POISSON EQUATION
High-order accurate solution of Laplace's equation on general regions using integral equation methods and fast Poisson solvers
N80-12781
POLAND
Purification of waters discharged from Polish lignite mines
[PB-297466/5] N80-12636
POLARIZATION [SPIN ALIGNMENT]
Magnetic susceptibility of chromium and its alloys
N80-12195
POLARIZATION [WAVES]
Reflector antennas with high efficiency and low depolarization
N80-12228
POLICIES
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12660
POLLUTION CONTROL
Premixing quality and flame stability: A theoretical and experimental study
[NASA-CR-3216] N80-12090
Environmental assessment report: Largi coal gasification systems for SNG
[PB-296109/0] N80-12204
POLLUTION MONITORING
Spectrometer for the first Spacelab payload
N80-12034
Gas sample storage
[PB-298350/0] N80-12152
Approaches to level 2 analysis based on level 1 results, MEG categories and compounds, and decision criteria — air pollution monitoring
[EPA-600/7-79-063A] N80-12153
A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] N80-12622
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629
Optimized chemiluminescence system for measuring atmospheric ammonia
[PB-296248/6] N80-12633
POLYATOMIC MOLECULES
Quasicontinuum physics — intramolecular dynamics in polyatomic molecules
[AD-A073117] N80-12144
POLYESTER RESINS
The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177
POLYETHYLENES
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183
POLYIMIDE RESINS
Second generation PMR polyimide/fiber composites
[NASA-CR-159666] N80-12118
POLYMERIC FILMS
Gas sample storage
[PB-298350/0] N80-12152
POLYMERIZATION
Preparation and characterization of latexes
N80-12115
POLYMERS
Fracture mechanics of inelastic polymers
[AD-A072792] N80-12178
Applications of solid state nuclear magnetic resonance techniques to the study of coals and polymers
[IS-T-822] N80-12838
POLYTROPIC PROCESSES
An empirical polytrope law for solar wind thermal electrons between 0.45 and 4.76 AU: Voyager 2 and Mariner 10
[NASA-TM-80594] N80-12981

POROUS BOUNDARY LAYER CONTROL
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350
PORTABLE EQUIPMENT
Preliminary applications and evaluation results. Lin-iscope: Proceedings of the Linkscope Conference
[NASA-CP-2112] N80-12384
POSITIVE FEEDBACK
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
POSITRON ANNIHILATION
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941
POSITRONS
Elemental composition, isotopes, electrons and positrons in cosmic rays
[NASA-TM-80571] N80-12984
POSTURE
A postural measurement system for induced body sway assessment
N80-12729
POTASSIUM CHLORIDES
Spectroscopic and optically detected magnetic resonance studies of $PO_2^{[-]}$ in potassium chloride — single crystals
N80-12127
POTENTIAL FIELDS
Gravitational and electromagnetic potentials of the stationary Einstein-Maxwell field equations
N80-12641
POTOMAC RIVER VALLEY [MD-VA-WV]
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
POWER LINES
Experimental verification of a combined environment accelerated aging method applied to electrical cable material
[SAND-78-1907A] N80-12424
POWER PLANTS
Waste heat rejection from geothermal power systems
[ORNL/TM-6533] N80-12575
PRANDTL NUMBER
Solutions of Prandtl's boundary layer equations using linear programming and mappings
N80-12302
PRECIPITATION (METEOROLOGY)
Estimates for wet and dry removals contribution to the residence time for atmospheric pollutants in the eastern United States
[SR-0980-6] N80-12626
Sierra Cooperative Project [SCPP] forecasting support, volume 1 — for enhancement of winter precipitation
[PB-298497/9] N80-12714
Comparison of LFM and MFM precipitation guidance for Nevada during dorem
[PB-298613/1] N80-12715
PREDICTION ANALYSIS TECHNIQUES
Remarks on the transonic flow past oscillating airfoils
N80-12009
Refinement of phase modeling in the infrared spectral region
[AD-A072725] N80-12113
PREDICTIONS
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
PREMIXED FLAMES
Premixing quality and flame stability: A theoretical and experimental study
[NASA-CR-3216] N80-12090
PREPOLYMERS
Preparation and characterization of latexes
N80-12115
PRESSURE DISTRIBUTION
The normal force on a cruciform missile at bank angles of a dig and 45 deg
N80-12037
Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-tandem
N80-12038
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053
An improved Woodward's panel method for calculating leading-edge and side-edge suction forces at subsonic and supersonic speeds
[NASA-CR-3205] N80-12061
Unsteady pressure distortion — in compressor inflow
N80-12333
PRESSURE EFFECTS
Burning velocities of a solid propellant, via a microwave technique, at elevated pressures and pressurization rates
N80-12187
Hydrostatic pressure effects on the motional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12910
PRESSURE MEASUREMENTS
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — Imgley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
Application of data acquisition system for on site measurements of wind effects on structures
N80-12357
PRESSURE PULSES
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
PRESTRESSING
A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429
PRINTED CIRCUITS
Solderability — printed circuit boards and copper surfaces
[SAND-78-1749C] N80-12169
PROBABILITY DENSITY FUNCTIONS
On the probability of crack propagation in a unidirectional composite with a single fiber breakage
[ESA-TT-524] N80-12125
PROBABILITY DISTRIBUTION FUNCTIONS
One-sided tolerance limits for a broad class of lifetime distributions with applications to data of limited accuracy
[AD-A072936] N80-12806
A special distribution result for bilinear forms
[AD-A072933] N80-12808
PROBABILITY THEORY
Maximum likelihood estimation of label imperfections and its use in the identification of mislabeled patterns
[NASA-CR-160364] N80-12805
PROBLEM SOLVING
A separable programming approach to the linear complementarity problem
[AD-A072925] N80-12767
Linear extremal problems in the class of univalent functions
N80-12779
PROCESS CONTROL [INDUSTRY]
Automated longwall guidance and control systems, phase 1
[NASA-CR-161329] N80-12538
Automated longwall guidance and control systems, phase 2, part 2: Vertical control system [VCS]
[NASA-CR-161330] N80-12539
Automated longwall guidance and control systems, phase 2, part 2: RCS, FAS, and MCS
[NASA-CR-161331] N80-12540
PRODUCTION ENGINEERING
Status of the PEATGAS process
[CONF-781045-3] N80-12199
Schottky barrier solar cell and method of fabrication
[NASA-CASE-NPO-13689-2] N80-12549
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/9] N80-12961
PROGRAM VERIFICATION [COMPUTERS]
Set evaluation — For software validation
N80-12758
PROGRAMMING LANGUAGES
Language recognition and the synchronization of cellular automata
N80-12759
Quality considerations in a programming language
N80-12760
The design and analysis of a parallel processing language
N80-12761
Design and measurement of implementation schemes for retention storage management as utilized in block structured languages
N80-12762
PROJECT MANAGEMENT
An evaluation of the bird/aircraft strike hazard at selected United Kingdom bases: RAF Mildenhall, RAF Alconbury, RAF Upper Heyford, RAF Bentwaters, RAF Fairford, RAF Lakenheath, and RAF Woodbridge
[AD-A073062] N80-12077
Low-temperature thermal energy storage program annual operating plan
[ORNL/TM-6605] N80-12568
PROJECT PLANNING
Recommended plan for project FRACT: A critical evaluation of fracture related analytical and computational techniques
[AD-A072773] N80-12447
Implementing packages of congestion-reducing techniques: Strategies for dealing with institutional problems of cooperative programs — project planning for urban transportation
[PB-298831/9] N80-12949
PROJECTILES
Contributions to ballistics, detonations, and pulse physics
[BMVG-FBWT-79-01] N80-12205
The use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile
N80-12207
Miscellanea concerning terminal ballistics
N80-12208
Measurements in interior ballistics, transmission, sensors
N80-12316
PROPAGATION MODES
Analysis and synthesis of corrugated conical horns
N80-12223
PROPELLANTS
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190
PROPULSION SYSTEM CONFIGURATIONS
Wind tunnel investigation of an oblique wing transport model at mach numbers between 0.6 and 1.4
[NASA-CR-137697] N80-12059
PROTECTIVE COATINGS
Application of sputtering to the improvement of coatings of superalloys
N80-12017
Electroless [chemiphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141
PROTON ENERGY
On the acceleration of energetic protons by interplanetary shock waves
N80-12975
PROTON SCATTERING
Parity violation in the scattering of 15 MeV protons by hydrogen
[LA-UR-78-2875] N80-12835
PUBLIC HEALTH
Climate, health and disease
N80-12679
PUBLIC LAW
Federal Aviation Act of 1958
N80-12954
PULSARS
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80585] N80-12989
PULSE CODE MODULATION
Bit rate reduction by automatic adaptation of quantizer step-size in DPCM systems
N80-12230
An adaptive quantizer with channel error recovery
N80-12231
Evaluation of adaptive speech coders under noisy channel conditions
N80-12233
PULSE COMMUNICATION
Evaluation of adaptive speech coders under noisy channel conditions
N80-12233
Statistical methods for estimating time and rate parameters of digital communication
[PB-297977/1] N80-12277
PUMPS
Technical and economic assessment of solar powered water pumping for remote areas
[SAND-79-0187] N80-12608
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
PURIFICATION
Ultrapurification of reactive metals
[IS-M-167] N80-12168
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620
PYRAMIDAL BODIES
Wake studies related to reentrant pyramids
[AD-A073825] N80-12105
PYRIDINES
Ultrasonic velocity and absorption measurements in several binary mixtures with pyridine
N80-12817

Q

Q SWITCHED LASERS
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404
Characterization of the Q-switched MOBLAS laser transmitter and its ranging performance relative to a PTM Q-switched system
[NASA-TM-80336] N80-12405
QUANTITATIVE ANALYSIS
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry — automatic test equipment
[FE-2537-9] N80-12193
QUANTUM CHEMISTRY
Collective effects, relaxation and localization of hole levels in atoms, molecules, solids, and adsorbates
[BNL-26068] N80-12940
QUANTUM CHROMODYNAMICS
Perturbative applications of quantum chromodynamics
N80-12945
QUANTUM MECHANICS
Perturbative applications of quantum chromodynamics
N80-12945
Semiclassical statistical mechanics
[LBL-9095] N80-12947

QUANTUM THEORY
Research program in elementary particle theory — study of particle theory in astrophysics, electromagnetic interactions, and quantum theory
[ORO-3992-362] N80-12842
QUARKS
Multiquark mesons
[ORO-3992-355] N80-12862
QUASARS
On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973
QUATERNIONS
The use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile
N80-12207

R

RADAR SIGNATURES
Subsurface electromagnetic target characterization and identification
[AD-A072491] N80-12272
RADAR TARGETS
Accuracy of parameter estimates for closely spaced optical targets
[AD-A073093] N80-12870
RADAR TRACKING
Restitution of missile trajectories by Kalman filtering-smoothing
N80-12023
RADIAL DISTRIBUTION
Structure of some refractory transition metal metalloid glasses
[CALT-822-105] N80-12162
RADIAL FLOW
Viscoelastic radial flow between parallel disks
N80-12309
RADIANCE
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] N80-12533
Airborn measurements of optical atmospheric properties, summary and review 3
[AD-A073121] N80-12645
RADIATION COUNTERS
Design and development of an ultra-thin solenoid for a high energy physics particle detector
[CONF-780952-28] N80-12288
RADIATION DAMAGE
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179
RADIATION DOSAGE
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation — risk and radiation dosage
[UCRL-13917-VOL-1] N80-12856
RADIATION EFFECTS
Circumsolar radiation data for central receiver simulation
[LBL-8371] N80-12647
Single crystal defect studies by means of ion channeling
N80-12917
RADIATION HARDENING
Metal-Nitride-Oxide-Semiconductor [MNOS] radiation characterization studies
[AD-A073637] N80-12287
The infinite parallel-wire array over a ground plane: A code for an EMP vulnerability assessment and hardening program
[AD-A073103] N80-12770
RADIATION MEASUREMENT
Measurement of circumsolar radiation: Status report
[LBL-8391] N80-12982
RADIATION PRESSURE
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-12020
Synthesis of flight results of the Cactus accelerometer for accelerations below one billionth G
N80-12033
RADIO ASTRONOMY
On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973
RADIO BEACONS
The ATS6 radio beacon pointing data: October 1975 - January 1976
[PB-297511/8] N80-12112
RADIO FREQUENCIES
Numerical studies of current generation by radio-frequency traveling waves
[PPPL-1506] N80-12296
RADIO FREQUENCY INTERFERENCE
Cross polarization interference reduction techniques
[AD-A072748] N80-12266
RADIO RELAY SYSTEMS
Tactical intelligence link control facility [TLCF] subsystem RF link remoting design and installation plans
[AD-A071799] N80-12263
RADIO TRANSMITTERS
Control of ELT false alarms
[NASA-CR-162502] N80-12295
Electromagnetic interference [EMI] radiative measurements for automotive applications
[PB-296605/7] N80-12276
RADIOACTIVE ISOTOPES
General purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7601-PR] N80-12854
RADIOACTIVE MATERIALS
X-ray source characteristics and detection efficiencies of prototype Lisiscopes
N80-12388
RADIOACTIVE WASTES
World Energy Data System [WENDS]. Volume II: Nuclear fission program summaries
[ANL-PMS-79-2-VOL-II] N80-12562
Evaluation of salt beds in New Mexico as a geologic repository for nuclear waste
[SAND-78-2086C] N80-12853
Suggested nuclear waste management radiological performance objectives
[NUREG-CR-0579] N80-12855
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation — risk and radiation dosage
[UCRL-13917-VOL-1] N80-12856
Engineering study of dry near-surface interim storage of fast flux test facility spent fuel
[RHO-LD-66] N80-12858
Preliminary area selection considerations for radioactive waste repositories in bedded salt
[UCID-18122] N80-12860
RADIOMETERS
Determinational of spectral signatures by radiometric ground measurements [realization and problems]
N80-12511
Effect of radiometric parameters on remote sensing images
N80-12514
RAIL TRANSPORTATION
The status of advanced propulsion systems for urban rail vehicles
[PB-297980/5] N80-12962
RAIN
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
The role of coalescence nuclei in warm rain initiation
[PB-298556/2] N80-12654
RAMAN SPECTRA
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
Analysis of Coherent Anti-Stokes Raman Spectra: Determination of molecular parameters
N80-12829
RAMAN SPECTROSCOPY
Laser-Raman spectroscopy
N80-12041
Phase transitions and statistical mechanics of lipid bilayers systems — using laser Raman spectroscopy
N80-12130
Characterization of oxidation product films on lead in aqueous media by in situ Raman spectroscopy
N80-12133
RANDOM NOISE
Limiting behaviors of certain continuous time-parameter stochastic processes and their applications — Wiener process
N80-12800
RANDOM SAMPLING
Applications of random-choice method to problems in shock and detonation-wave dynamics
[UTIAS-240] N80-12373
Towards reconstruction of an un-paired random sample — from a bivariate normal distribution
N80-12798
RANGELANDS
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
RANGES [FACILITIES]
The 19702A GSRS, missile number 336, round number B-19
[AD-A073110] N80-12702
RANK TESTS
Rank tests for restricted alternative problems in multivariate analysis
N80-12799
RANKINE CYCLE
Evaluation of solar Rankine-cycle engine systems
[SAND-78-0986] N80-12571
RAPID TRANSIT SYSTEMS
The status of advanced propulsion systems for urban rail vehicles
[PB-297980/5] N80-12962
RARE EARTH COMPOUNDS
The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907
RARE EARTH ELEMENTS
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-78-XX-95] N80-13938
RATIONAL FUNCTIONS
Uniform approximation by rational functions having restricted denominators
[AD-A072835] N80-12786
RAYLEIGH SCATTERING
Rayleigh temperature profiles in a hydrogen diffusion flame
[SAND-78-8726] N80-12148
REACTION KINETICS
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121
The methanation reaction on ruthenium thin films: A mechanistic investigation
N80-12128
Materials compatibility in liquid sodium
[HEDL-SA-1559] N80-12147
The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
Kinetic spectroscopy of metal atom/oxidizer chemiluminescent reactions for laser applications
[AD-A073082] N80-12411
REACTOR DESIGN
Tandem mirror fusion reactor studies
[UCID-17990] N80-12886
Volt-second consumption during the startup phase of a large Tokamak
[PPPL-1508] N80-12888
Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear solenoidal reactor
[LA-7359-P] N80-12889
Conceptual design of a Demonstration Tokamak Hybrid Reactor [DTHR]
[WFPS-TME-107] N80-12898
REACTOR MATERIALS
Ultrapurification of reactive metals
[IS-M-167] N80-12168
General and particular aspects of the particulate bed behaviour in the Post Accident Heat Removal situation for Liquid Metal Fast Breeder Reactors
N80-12349
REACTOR SAFETY
General purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7601-PR] N80-12854
Safety aspects of activation products in a compact Tokamak Fusion Power Plant
[PNL-2823] N80-12893
REACTOR STARTUP TESTS
Volt-second consumption during the startup phase of a large Tokamak
[PPPL-1508] N80-12888
REACTOR TECHNOLOGY
World Energy Data System [WENDS]. Volume II: Nuclear fission program summaries
[ANL-PMS-79-2-VOL-II] N80-12562
Tandem mirror fusion reactor studies
[UCID-17990] N80-12886
Volt-second consumption during the startup phase of a large Tokamak
[PPPL-1508] N80-12888
Superconducting magnets for mirror machines
[UCRL-81578] N80-12892
Thermal-hydraulic considerations in magnetically confined fusion reactors
[GA-A-15365] N80-12896
REACTORS
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
READERS
Skimming stories in real time: An experiment in integrated understanding
N80-12763
REAL TIME OPERATION
Guided wave acoustooptic devices for wideband real-time signal processing
N80-12253
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] N80-12530
Skimming stories in real time: An experiment in integrated understanding
N80-12763
RECEIVERS
Naval blue-green single-pulse downlink propagation model
[AD-A071780] N80-12406
RECIPROCAL THEOREMS
Reciprocity principle in duct acoustics
[NASA-TM-79300] N80-12824

RECONNAISSANCE
Analyst level documentation for the search and rescue simulation [Sarsim]
[AD-A073155] N80-12078
RECTANGULAR WINGS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Calculation of transonic flows around wings
N80-12014
REDUNDANT COMPONENTS
Space communications — conference
N80-12216
REENTRY SHIELDING
Preliminary design procedure for insulated structures subjected to transient heating
[NASA-TP-1534] N80-12438
REENTRY VEHICLES
Improvements to the solution of the viscous shock layer equations
[AD-A072673] N80-12071
Wake studies related to resistant pyramids
[AD-A073825] N80-12105
REFLECTANCE
On the angular variation of solar reflectance of snow
[NASA-TM-80576] N80-12536
REFRACTIVITY
Improved flow visualization by wise use of Resonant Refractivity
[AD-A073074] N80-12374
REFRACTORY METAL ALLOYS
Structure of some refractory transition metal metalloid glasses
[CALT-822-105] N80-12162
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
REGENERATORS
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Fundamentals of Regenerators
N80-12347
REGIONAL PLANNING
Future remote sensing tasks in regional planning
N80-12484
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
The determination of land usages for planning and cartography
N80-12517
A regional approach to forecasting electric energy requirements for environmental assessments
N80-12619
REGULATIONS
Federal Aviation Act of 1958
N80-12954
REINFORCEMENT [STRUCTURES]
Reinforcement to control thermal and shrinkage cracking
[PB-296412/8] N80-12237
Hysteretic behavior of lightweight reinforced concrete beam-column subassemblages
[PB-298267/6] N80-12451
RELATIVISTIC ELECTRON BEAMS
Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear solenoidal reactor
[LA-7359-P] N80-12889
RELATIVISTIC PLASMAS
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
RELAXATION TIME
Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923
RELIABILITY ANALYSIS
Reliability and maintainability analysis: A conceptual design model
[AD-A073120] N80-12949
RELIABILITY ENGINEERING
Space communications — conferences
N80-12216
Reliability performances of systems with a switching matrix
N80-12217
RELIEF MAPS
The effectiveness of two and three dimensional isarithmic surfaces in communicating magnitude, gradient, and pattern information
N80-12454
REMOTE SENSORS
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
On measurements from aircraft — conference, Hanover, 29-31 August 1977
[BMFT-FB-W-78-04] N80-12467
Aims and tasks of the aircraft test program
N80-12468
On the current state of remote sensing techniques
N80-12469
Future remote sensing program of the DFVLR
N80-12470
International cooperation in remote sensing
N80-12471
From satellite images to aerial survey photographs: Comparison between observations of the Jade region made with different sensors
N80-12472
Scanner coordination problems: Images from over the sea
N80-12473
Numerical treatment of IR thermal data for the German Bight test region
N80-12474
Evaluation of thermal images of the Jade region
N80-12475
Determination of currents in coastal regions using multispectral scanning images
N80-12476
Water quality in coastal regions: Evaluation of thermal images of factory water coolant inlets
N80-12477
On the problem of the remote sensing of substances in water by multispectral scanning
N80-12478
Research into determining chemical parameters at the surface of the sea by remote sensing
N80-12479
Colored substance mixing experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Multispectral classification of sand bank regions — Germany
N80-12481
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Making morphological maps of sand banks from aerial photographs
N80-12483
Future remote sensing tasks in regional planning
N80-12484
Interpretation of IR and MSS data for town areas
N80-12485
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-12487
Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12488
Thermal images and climatic changes in regrouped vineyards on mountain slopes
N80-12489
Large scale thermal images as a means of distinguishing between building structures in a town
N80-12490
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
Interpretation of water quality using remote sensing techniques
N80-12493
Determination of soil water contents from radiometric measurements and IR scanning data
N80-12494
Classification of agricultural land with the aid of remote sensing methods
N80-12495
Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops
N80-12497
Application of a hierarchial classification method for special problems — correcting direction dependent variations in recorded signals
N80-12502
Interactive correction of classified photographs
N80-12503
Evaluations in the framework of the FMP program using the digital image processing system DIDAK
N80-12507
Correspondance problems in polygonal segmented multispectral digital images
N80-12508
Preliminary results on the use of digital methods with center of gravity data reduction in a pre-Alp test region
N80-12509
Application of DIBIAS programs for improvements and geoscientific evaluations of LANDSAT photographs of central Morocco and Sudan
N80-12510
Determinational of spectral signatures by radiometric ground measurements [realization and problems]
N80-12511
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
N80-12512
Spectral reflection from agricultural and forest regions during the vegetation period
N80-12513
Effect of radiometric parameters on remote sensing images
N80-12514
The multispectral scanner as an instrument for signature determinations
N80-12515
Determination of the optical properties of the sea in the German bight
N80-12516
The determination of land usages for planning and cartography
N80-12517
The relationship of red and photographic infrared spectral [illegible] to grain yield variation within a winter wheat field
[NASA-TM-80328] N80-12532
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] N80-12533
Interim calibration report for the SMMR simulator
[NASA-TM-80564] N80-12534
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12535
The passive microwave remote sensing of soil moisture: The effect of tilled row structure
[NASA-TM-80589] N80-12537
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] N80-12547
A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] N80-12622
Remote Sensing and Problems of the Hydrosphere
[NASA-CP-2109] N80-12718
REMOTELY PILOTED VEHICLES
The development of the DAST 1 remotely piloted research vehicle for flight testing an active flutter suppression control system
N80-12083
RESCUE OPERATIONS
Analyst level documentation for the search and rescue simulation [Sarsim]
[AD-A073155] N80-12078
Control of ELT false alarms
[NASA-CR-162502] N80-12255
RESEARCH AIRCRAFT
V/STOL flight simulation
[NASA-TM-81156] N80-12100
RESEARCH AND DEVELOPMENT
Research studies on neodymium pentaphosphate miniature lasers
[AD-A073140] N80-12408
Inventory of advanced energy technologies and energy conservation research and development, 1976-1978, volume 1
[GPO-41-481] N80-12550
Research recommendations
N80-12738
Solid state research
[AD-A073152] N80-12934
RESEARCH MANAGEMENT
Low-temperature thermal energy storage program annual operating plan
[ORNL/TM-6605] N80-12568
Research on climatic change and variability
N80-12698
Automatic Data Processing Equipment [ADPE] acquisition plan for the medical sciences
[JSC-16075] N80-12746
AGARD bulletin technical programme, 1980
[AGARD-BULL-79/2] N80-12990
RESIDENTIAL AREAS
Aircraft noise and the market for residential housing: Empirical results for seven selected airports
[PB-297681/9] N80-12635
RESIDUES
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2247-2] N80-12191
RESONANCE
Quasicontinuum physics — intramolecular dynamics in polyatomic molecules
[AD-A073117] N80-12144
Improved flow visualization by wise use of Resonant Refractivity
[AD-A073074] N80-12374
Radial diffusion of resonant particles in tandem mirrors — ionic diffusion of resonant particles in mirrors is derived from kinetic theory
[UCID-17992] N80-12902
RESONANT FREQUENCIES
Intense electrostatic waves near the upper hybrid resonance frequency
N80-12640

RESOURCE ALLOCATION
Stochastic games, oligopoly theory and competitive resource allocation
[AD-A073030] N80-12810
RESOURCES MANAGEMENT
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] N80-12722
A workforce and training profile for solid waste management and resource recovery
[PB-296612/3] N80-12968
REVERSE FIELD PINCH
Experiments on the ZT-S reversed-field pinch, August - December 1978
[LA-7862-MS] N80-12885
REYNOLDS NUMBER
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019
RIGID STRUCTURES
Fracture mechanics of inelastic polymers
[AD-A072792] N80-12178
RINGS [MATHEMATICS]
On rings with self-duality
N80-12811
RISERS
Experimental and theoretical investigation of pipe riser clamps
N80-12428
RISK
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation — risk and radiation dosage
[UCRL-13917-VOL-1] N80-12856
RIVER BASINS
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
RIVERS
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
ROCKET EXHAUST
Refinement of plume modeling in the infrared spectral region
[AD-A072725] N80-12113
Numerical computation of electromagnetic scattering by inhomogeneous penetrable bodies
[AD-A073143] N80-12268
Position paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12662
ROCKET LAUNCHING
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032
The 19304DT GSRS, missile no. 1031, round no. V-46
[AD-A073388] N80-12699
ROCKET SOUNDING
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
Wind study for high altitude platform design
[NASA-RP-1044] N80-12661
The 14819C Lance, missile number 3396, round number 333 APL
[AD-A073109] N80-12701
The 19702A GSRS, missile number 302, round number B-20
[AD-A073111] N80-12703
ROCKS
Application of porous media to heat storage underground
N80-12345
ROLL
Real time digital model of a rolling airframe
[AD-A073456] N80-12075
ROLLER BEARINGS
Improved capabilities to detect incipient bearing failures
[AD-A073123] N80-12416
ROTARY STABILITY
Rotary balance data for a typical single-engine general aviation design for an angle-of-attack range of 8 degrees to 35 degrees, 3. Effect of wing leading-edge modifications, model A
[NASA-CR-3102] N80-12060
ROTARY WINGS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
ONERA aerodynamic research work on helicopters
N80-12030
ROTATING STALLS
Rotating stall and surge in axial compressors
N80-12328
Flow measurements in a rotating stall cell
N80-12334
Rotating stall in axial flow compressors
N80-12337
ROTATION
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation — surface navigation
[AD-A073153] N80-12081
Oil whirl and critical instabilities in rotor-bearing systems
N80-12412
ROTOR AERODYNAMICS
ONERA aerodynamic research work on helicopters
N80-12030
Unsteady flow in turbomachines, volume 2
[VKI-LEC-SER-1979-3-VOL-2] N80-12331
Flow measurements in a rotating stall cell
N80-12334
ROTOR BLADES
Turbomachine wake transport and interaction
N80-12329
ROTOR BLADES [TURBOMACHINERY]
Blade wake interference: Temperature effect — on cascade flow
N80-12335
ROTORS
Oil whirl and critical instabilities in rotor-bearing systems
N80-12412
RUNWAYS
Behavior of aircraft antiskid braking systems on dry and wet runway surfaces. A slip-velocity-controlled, pressure-bias-modulated system
[NASA-TP-1051] N80-12084
RUTHENIUM
The methanation reaction on ruthenium thin films: A mechanistic investigation
N80-12128

S

S GLASS
Mechanical property characterization of intraply hybrid composites
[NASA-TM-79306] N80-12120
SADDLE POINTS
Some minimax principles with applications in nonlinear elliptic boundary value problems and global vortex flow
N80-12304
SAFETY FACTORS
Some contemplated improvements to the prototype Lixiscope
N80-12389
SAFETY MANAGEMENT
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079
Investigations of the safety of Li/SOCl sub 2 batteries
[AD-A072962] N80-12555
SALT BEDS
Evaluation of salt beds in New Mexico as a geologic repository for nuclear waste
[SAND-78-2086C] N80-12853
Preliminary area selection considerations for radioactive waste repositories in bedded salt
[UCID-18122] N80-12860
SALTON SEA [CA]
Using surface waters for supplementing injection at the Salton Sea Geothermal Field [SSGF], Southern California
[UCRL-83011] N80-12561
SAMARIUM
X-ray diffraction study of the alloy system $SmF_{[x]}S_{[1-x]}$
N80-12926
SANDS
Multispectral classification of sand bank regions — Germany
N80-12481
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Making morphological maps of sand banks from aerial photographs
N80-12483
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827
SANDWICH STRUCTURES
Multiwall thermal protection system
[NASA-CASE-LAR-12620-1] N80-12117
SATELLITE NETWORKS
The telecommunication satellite as an integrated time division transmission-switching system
N80-12220
SATELLITE OBSERVATION
From satellite images to aerial survey photographs: Comparison between observations of the Jade region made with different sensors
N80-12472
SATELLITE ORBITS
An intermediate-averaged theory for high altitude orbits
[AD-A073094] N80-12104
SATELLITE POWER TRANSMISSION [TO EARTH]
Satellite Power Systems [SPS] concept definition study. Volume 4: SPS point design definition
[NASA-CR-150683] N80-12106
SATELLITE SOLAR ENERGY CONVERSION
Solar power satellite system definition study. Part 1: Midterm briefing
[NASA-CR-160369] N80-12108
SATELLITE TRANSMISSION
Space communications — conferences
N80-12216
Performance and impairments in a QPSK satellite to ground link
N80-12218
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
The telecommunication satellite as an integrated time division transmission-switching system
N80-12220
Low sidelobe level low-cost earth station antennas for the 12 GHz broadcasting satellite service
[NASA-CR-159703] N80-12239
SCANNING
Scanner coordination problems: Images from over the sea
N80-12473
SCATTERING CROSS SECTIONS
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
SCATTEROMETERS
IGOS improvements for Seasat
[NASA-CR-162604] N80-12107
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] N80-12530
SCHLIEREN PHOTOGRAPHY
Improved flow visualization by wise use of Resonant Refractivity
[AD-A073074] N80-12374
SCHOTTKY DIODES
Schottky barrier solar cell and method of fabrication
[NASA-CASE-NPO-13609-2] N80-12549
SCIENTIFIC SATELLITES
The ATS6 radio beacon pointing data: October 1975 - January 1976
[PB-297511/6] N80-12112
SCINTILLATION
Exciton dynamics in alpha-particle tracks in organic crystals: Magnetic field study of the scintillation in anthracene and tetracene crystals
N80-12921
SCINTILLATION COUNTERS
X-ray source characteristics and detection efficiencies of prototype Lixiscopes
N80-12388
The time-of-flight system on the Goddard medium energy gamma-ray telescope
[NASA-TM-80579] N80-12970
SCRUBBERS
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620
SEA BREEZE
Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712
SEA WATER
On the problem of the remote sensing of substances in water by multispectral scanning
N80-12478
Colored substance mixing experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Determination of the optical properties of the sea in the German bight
N80-12516
SEALS [STOPPERS]
Modified face seal for positive film stiffness
[NASA-CASE-LEW-12989-1] N80-12414
SEARCH PROFILES
Search algorithms and related techniques for the analysis of spectrometric data
N80-12137
SEASAT PROGRAM
SEASAT: Gulf of Alaska experiment. Surface truth data inventory
[PB-294616] N80-12546
SEASAT-A SATELLITE
IGOS improvements for Seasat
[NASA-CR-162604] N80-12107

SEDIMENT TRANSPORT
An analysis of longshore currents and associated sediment transport in the surf zone
[PB-298291/6] N80-12724
SEISMIC WAVES
Seismic vulnerability, behavior and design of buried pipelines, phase 1
[PB-298269/2] N80-12240
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
Analysis of linear seismic signals: Determination of instrumental parameters and seismic velocity distribution
[NASA-CR-162905] N80-12980
SEISMOLOGY
Structure of the earth's crust and upper mantle plotted from data of seismic studies
[UCRL-TRANS-11392] N80-12650
SEMICONDUCTOR DEVICES
Investigation of moisture measurements, failure rate and leak rate and a study of moisture infusion
[PB-299172/7] N80-12299
Measurement techniques for high-power semiconductor materials and devices: — application to energy technologies
[PB-298574/5] N80-12300
Semiconductor measurement technology: Thermal resistance measurements on power transistors
[PB-298318/7] N80-12301
Photoelectrochemical conversion of optical energy to electricity and fuels
[AD-A072861] N80-12556
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072766] N80-12936
SEMICONDUCTOR DIODES
Millimeter-wave mixers and detectors
[AD-A073591] N80-12284
SEMICONDUCTORS [MATERIALS]
Measurement techniques for high-power semiconductor materials and devices: — application to energy technologies
[PB-298574/5] N80-12300
A study of the optical and transport properties of the ternary semiconducting compounds $Al_xGa_{1-x}As$ high pressure
N80-12911
Electron conductivity mobility in semiconductors based on a dielectric function modification of the Dingle impurity ion potential
N80-12922
Solid state research
[AD-A073152] N80-12934
SENEGAL
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
SEPARATED FLOW
Separation of a flow along a line of a smooth surface
N80-12022
SEQUENTIAL ANALYSIS
Covariance sequence approximation with applications to spectrum analysis and digital filter design
[AD-A072884] N80-12783
SERVICE LIFE
Lifetime prediction for optical glass fibers
[AD-A072771] N80-12872
SERVICES
Baltimore applications project
[NASA-TM-80577] N80-12957
SET THEORY
Set evaluation — For software validation
N80-12758
Good functions, elementary sets and automata
N80-12813
SEYFERT GALAXIES
The he I triplet line emission in class 1 Seyfert galaxies
N80-12972
SH-3 HELICOPTER
Sea King Mk. 50 helicopter flight control system. A mathematical model of the AFCS [autostabilizer/autopilot mode]
[ARL/AERO-NOTE-387] N80-12099
SHALE OIL
Overview of in situ oil shale technology and recent advances in true in situ retort modeling
[SAND-78-2367C] N80-12543
Shale oil: US and world resources and prospects for near-term commercialization in the United States
[ORAU/IEA-79-8[R]] N80-12544
SHALES
Method of analysis and precision of X-ray diffraction data from Ohio shale — used in geological survey of black shales
[METC/CR-78/16] N80-12541
SHEAR FLOW
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379
SHEAR LAYERS
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
SHEAR STRENGTH
Effect of constituent properties on composite strength
[UCRL-83051] N80-12124
SHELLS [STRUCTURAL FORMS]
A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429
SHOCK LAYERS
Improvements to the solution of the viscous shock layer equations
[AD-A072673] N80-12071
SHOCK TUBES
A shock tube investigation of silo-launched vehicle aerodynamic flow asymmetries
[AD-A071811] N80-12110
Shock tube research looking at the origin of the Machwaves inside and outside supersonic jets
N80-12211
SHOCK WAVE GENERATORS
Shock initiation and detonation models in one and two dimensions
[UCID-18024] N80-12194
SHOCK WAVE INTERACTION
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
Analysis of the separation due to shock wave-turbulent boundary layer interaction in transonic flow
N80-12031
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefield hypersonic flow
N80-12090
Analysis of the structure deformation of sodium chloride submitted by a shock wave
N80-12212
SHOCK WAVES
Supersonic combustion, air dissociation through shock waves and aerodynamics of chemically reacting gases in a Pfauter converging - diverging nozzles — supersonic combustion ramjet engines
[AD-A073135] N80-12097
On the acceleration of energetic protons by interplanetary shock waves
N80-12975
SHORELINES
The first five years of coastal zone management
[PB-298780/7] N80-12723
An analysis of longshore currents and associated sediment transport in the surf zone
[PB-298291/6] N80-12724
SHRINKAGE
Reinforcement to control thermal and shrinkage cracking
[PB-298412/8] N80-12237
Recent concepts: Their influence on code predictions of shrinkage and creep — in concretes
[PB-298413/6] N80-12238
SIDELOBE REDUCTION
Low sidelobe level low-cost earth station antennas for the 12 GHz broadcasting satellite service
[NASA-CR-159705] N80-12259
SIERRA NEVADA MOUNTAINS [CA]
Sierra Cooperative Project [SCPP] forecasting support, volume 1 — for enhancement of winter precipitation
[PB-298497/9] N80-12714
SIGNAL ANALYZERS
Burst processing — in performing arithmetic
[AD-A072872] N80-12807
SIGNAL DETECTORS
Millimeter-wave mixers and detectors
[AD-A073591] N80-12284
SIGNAL ENCODING
Space communications — conferences
N80-12216
Transform coding of PAL composite signals
N80-12235
SIGNAL PROCESSING
Bit rate reduction by automatic adaptation of quantizer step-size in DPCM systems
N80-12230
Guided wave acoustooptic devices for wideband real-time signal processing
N80-12253
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] N80-12530
Shallow bulk acoustic waves
[AD-A072742] N80-12825
Turbulence measurements by digital spectral estimation in the ohmically heated Protocleo Torsatron — digital techniques of signal processing to measure plasma turbulence
N80-12879
SIGNAL RECEPTION
Transform coding of PAL composite signals
N80-12235
SIGNAL TO NOISE RATIOS
Performance and impairments in a QPSK satellite to ground link
N80-12218
Evaluation of adaptive speech coders under noisy channel conditions
N80-12233
SIGNAL TRANSMISSION
Measurements in interior ballistics, transmission, sensors
N80-12316
SIGNATURES
Determination of spectral signatures by radiometric ground measurements [realization and problems]
N80-12511
SILANES
FT-NMR determination of silane hydrogen
[MHSMP-78-45] N80-12181
SILICON
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933
SILICON ALLOYS
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
SILICON COMPOUNDS
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833
SILOXANES
FT-NMR determination of silane hydrogen
[MHSMP-78-45] N80-12181
SIMILARITY NUMBERS
Similarity in nozzle flows with vibrational nonequilibrium
N80-12043
SIMULATORS
Interim calibration report for the SMMR simulator
[NASA-TM-80564] N80-12534
SIMULTANEOUS EQUATIONS
A collection of equation-solving codes for the CRAY-1 — assembly language
[AD-A073033] N80-12769
SINGLE CRYSTALS
Spectroscopic and optically detected magnetic resonance studies of $FO_2^{[-]}$ in potassium chloride — single crystals
N80-12127
Single crystal defect studies by means of ion channeling
N80-12917
SIZE [DIMENSIONS]
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768
SKY RADIATION
Some considerations about sky noise temperature at frequencies above 10GHz
N80-12229
SKYLARK ROCKET VEHICLE
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
SLOTS
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053
SLOTTED WIND TUNNELS
A simplified model for the viscous crossflow in a slotted test section
[NASA-CR-3206] N80-12372
SNOW
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
On the angular variation of solar reflectance of snow
[NASA-TM-80576] N80-12536
SOCIOLOGY
Impacts of climate change and variability on society
N80-12697
SODIUM
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
SODIUM CHLORIDES
Analysis of the structure deformation of sodium chloride submitted by a shock wave
N80-12212
SODIUM COMPOUNDS
Na beta-alumina: Structure analysis of a superionic conductor
N80-12924
SODIUM REACTOR EXPERIMENT
Materials compatibility in liquid sodium
[HEDL-SA-1559] N80-12147
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
General and particular aspects of the particulate bed behaviour in the Post Accident Heat Removal situation for Liquid Metal Fast Breeder Reactors
N80-12349
SOIL MECHANICS
Analytical procedures in soil dynamics
[PB-298445/9] N80-12243

Stabilization and compaction
[PB-298935/8] N80-12244
SOIL MOISTURE
Determination of soil water contents from radiometric measurements and IR scanning data
N80-12494
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Catchment, north west of London, U.K.
[E80-10006] N80-12522
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
The passive microwave remote sensing of soil moisture: The effect of tilled row structure
[NASA-TM-80589] N80-12537
SOILS
Stabilization and compaction
[PB-298935/8] N80-12244
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
TELLUS newsletter 1 — Beauce, France
[E80-10029] N80-12531
Field methods for determining nitrous oxide fluxes over soil — from fertilizer nitrogen
N80-12617
SOLAR CELLS
Satellite Power Systems [SPS] concept definition study. Volume 4: SPS point design definition
[NASA-CR-150683] N80-12106
Schottky barrier solar cell and method of fabrication
[NASA-CASE-NPO-13689-2] N80-12549
Preparation and characterization of hydrogenated amorphous silicon thin films and thin film solar cells produced by ion plating techniques
[SAN-1846-T1] N80-12560
SOLAR COLLECTORS
Fluid Dynamics of Porous Media in Energy Applications, volume 1 — heat storage and transfer in solar energy conversion systems
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
Heat storage and thermal transfer aspects of the dynamic behaviour of a packed bed
N80-12342
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Application of packed beds to energy storage use of latent heat of fusion
N80-12353
Optimization of photovoltaic/thermal collector heat pump systems
[COO-4577-7] N80-12566
Double-exposure collector system
[TID-28964] N80-12593
Study of corrosion and its control in aluminum solar collectors
[COO-2934-7] N80-12609
Circumsolar radiation data for central receiver simulation
[LBL-8371] N80-12647
SOLAR COOLING
October 1978 environmental data for sites in the National Solar Data Network
[SOLAR/0010-78-10] N80-12585
Experimental test facility for evacuation of solar control strategies
[LBL-8308] N80-12586
Solar Heating And Cooling Of Buildings [SHACOB] Commercialization report. Part B: Analysis of market development, volume 2
[DOE/TIC-10071] N80-12603
SOLAR ELECTRONS
An empirical polytrope law for solar wind thermal electrons between 0.45 and 4.76 AU: Voyager 2 and Mariner 10
[NASA-TM-80594] N80-12981
SOLAR ENERGY
Application of packed beds to energy storage use of latent heat of fusion
N80-12353
Evaluation of solar Rankine-cycle engine systems
[SAND-78-0986] N80-12571
Materials problems in reversible chemical reaction storage systems for solar energy
[SAND-78-8698] N80-12574
Solar mechanical energy storage project
[SAND-78-1982C] N80-12590
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591
Project CESA-1, a 1 MW solar power plant in Almeria
[AED-CONF-78-212-011] N80-12614
SOLAR ENERGY CONVERSION
Fluid Dynamics of Porous Media in Energy Applications, volume 1 — heat storage and transfer in solar energy conversion systems
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
A photovoltaic power system in the remote African village of Tangaye, Upper Volta
[NASA-TM-79318] N80-12582
Effect of operating temperatures on the cost of energy from solar thermal electric power plants
[SAND-79-0801] N80-12563
Systems Analysis and testing [SAT] program
[SERI/PR-35-313] N80-12565
The great adventure: A report on the 10 regional public hearings on solar energy for the domestic policy review
[HCP/U6354-01] N80-12567
Operational experience with drain-down solar systems
[IS-M-166] N80-12576
Direct labor requirements for select solar energy technologies: A review and synthesis
[SERI/RR-53-045] N80-12578
October 1978 environmental data for sites in the National Solar Data Network
[SOLAR/0010-78-10] N80-12585
Residential on site solar heating systems. A project evaluation using the capital asset pricing model
[LBL-8298] N80-12588
Analysis of the California solar resource, volume 2
[LBL-7860-VOL-2] N80-12589
Mead, Nebraska, 25-kW photovoltaic power system
[COO-4094-10] N80-12592
Architectural concerns in solar system design and installation
[SOLAR/0801-79-01] N80-12607
Solar-powered steam generator heliostat
[BNL-50974] N80-12610
Photothermal conversion surface measurements using photoacoustic and photothermal spectroscopies
[IS-M-202] N80-12611
Photothermal conversion of solar energy into electricity
[DOE-TR-159] N80-12612
Circumsolar radiation data for central receiver simulation
[LBL-8371] N80-12647
Solar-climatic statistical study. Summary report, volume 1
[HCP/T4016-1] N80-12707
SOLAR FLUX
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639
Measurement of circumsolar radiation: Status report
[LBL-8391] N80-12982
SOLAR GENERATORS
Technical and economic assessment of solar powered water pumping for remote areas
[SAND-79-8187] N80-12608
Project CESA-1, a 1 MW solar power plant in Almeria
[AED-CONF-78-212-011] N80-12614
SOLAR HEATING
Assist of an air-to-air heat pump using solar heated hot water
N80-12413
October 1978 environmental data for sites in the National Solar Data Network
[SOLAR/0010-78-10] N80-12585
Experimental test facility for evacuation of solar control strategies
[LBL-8308] N80-12586
Residential on site solar heating systems. A project evaluation using the capital asset pricing model
[LBL-8298] N80-12588
Solar Heating And Cooling Of Buildings [SHACOB] Commercialization report. Part B: Analysis of market development, volume 2
[DOE/TIC-10071] N80-12603
SOLAR HOUSES
Performance of Los Alamos solar Mobile/Modular Home Unit no. 1
[LA-UR-78-2587] N80-12577
SOLAR POWER SATELLITES
Solar power satellite system definition study, volume 5. Phase 2: Final briefing
[NASA-CR-160380] N80-12109
SOLAR RADIATION
On the angular variation of solar reflectance of snow
[NASA-TM-80576] N80-12536
Solar-climatic statistical study. Summary report, volume 1
[HCP/T4016-1] N80-12707
SOLAR WIND
An empirical polytrope law for solar wind thermal electrons between 0.45 and 4.76 AU: Voyager 2 and Mariner 10
[NASA-TM-80594] N80-12981
SOLDERING
Solderability — printed circuit boards and copper surfaces
[SAND-78-1749C] N80-12369
SOLENOIDS
Design and development of an ultra-thin solenoid for a high energy physics particle detector
[CONF-780952-28] N80-12288
Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear solenoidal reactor
[LA-7939-P] N80-12889
Superconducting magnets for mirror machines
[UCRL-81578] N80-12892
SOLID ROCKET PROPELLANTS
Burning velocities of a solid propellant, via a microwave technique, at elevated pressures and pressurization rates
N80-12187
Positive paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12662
Airborne measurements of cloud-forming nuclei and aerosol particles in stabilized ground clouds produced by solid rocket booster firings
[NASA-CR-160357] N80-12663
Laboratory investigations of cloud forming nuclei and aerosol particles from unpressurized burns of space shuttle propellant
[NASA-CR-160358] N80-12664
SOLID STATE
Applications of solid state nuclear magnetic resonance techniques to the study of coals and polymers
[IS-T-822] N80-12838
Collective effects, relaxation and localization of hole levels in atoms, molecules, solids, and adsorption
[BNL-26068] N80-12940
SOLID STATE DEVICES
Solid state research
[AD-A073152] N80-12934
SOLID SURFACES
Spreading kinetics of a liquid drop on a solid surface
N80-12307
SOLID WASTES
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963
A workforce and training profile for solid waste management and resource recovery
[PB-298612/3] N80-12968
SOLUTIONS
Target factor analysis of gas-chromatographic retention indices — multivariate statistical analysis of gas chromatography data for solutions and solvents
N80-12129
Oscillatory flow birefringence measurements of block copolymers in solution
N80-12174
SOLVENTS
Target factor analysis of gas-chromatographic retention indices — multivariate statistical analysis of gas chromatography data for solutions and solvents
N80-12129
SONAR
Method for shaping and aiming narrow beams — using a linear frequency chirp for sonar reception
[NASA-CASE-NPO-14632-1] N80-12256
A study in the determination of depth information from underwater acoustical scanners
N80-12438
SOUND AMPLIFICATION
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
SOUND PROPAGATION
Ground effects on aircraft noise — near grazing incidence
[NASA-TM-80185] N80-12820
A time dependent difference theory for sound propagation in ducts with flow — characteristic of inlet and exhaust ducts of turbofan engines
[NASA-TM-79302] N80-12823
SOUND TRANSMISSION
Reciprocity principle in duct acoustics
[NASA-TM-79300] N80-12824
General effects of current and sound-speed variations on shortrange acoustic transmission in cyclonic eddies
[AD-A072765] N80-12826
SOUND WAVES
Shallow bulk acoustic waves
[AD-A072742] N80-12825
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072764] N80-12936
SOUTH AMERICA
Renewable resources and agriculture in Latin America in relation to the stability of climate
N80-12685

Tide tables 1980. High and low water predictions. East Coast of North and South America including Greenland
[PB-298726/1] N80-12725
SPACE HEATING [BUILDINGS]
Optimization of photovoltaic/thermal collector heat pump systems
[COO-4577-7] N80-12566
Standby conservation plan no. 2: Emergency building temperature restrictions. Authorities: Need, rationale, operation
[DOE/ERA-0048] N80-12582
Emissions assessment of conventional stationary combustion systems. Volume 1: Gas- and oil-fired residential heating sources
[PB-298494/6] N80-12637
SPACE POWER REACTORS
General purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7601-PR] N80-12854
SPACE PROCESSING
Traffic model for commercial payloads in the Materials Experiment Assembly [MEA] — market research in commercial space processing
[NASA-CR-162456] N80-12958
SPACE SHUTTLE PAYLOADS
Traffic model for commercial payloads in the Materials Experiment Assembly [MEA] — market research in commercial space processing
[NASA-CR-162456] N80-12958
SPACE SHUTTLES
Control Computational Facility CCF communications subsystem options
[NASA-CR-160383] N80-12257
An introduction to the BANNING design automation system for shuttle microelectronic hardware development
[NASA-TM-80831] N80-12282
Position paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12662
Laboratory investigations of cloud forming nuclei and aerosol particles from supernatured burns of space shuttle propellant
[NASA-CR-160358] N80-12664
Automatic Data Processing Equipment [ADPE] acquisition plan for the medical sciences
[JSC-16075] N80-12746
SPACE TRANSPORTATION SYSTEM
Orbit decay analysis of STS upper stage boosters
[NASA-CR-160385] N80-12103
SPACEBORNE EXPERIMENTS
Traffic model for commercial payloads in the Materials Experiment Assembly [MEA] — market research in commercial space processing
[NASA-CR-162456] N80-12958
SPACEBORNE PHOTOGRAPHY
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] N80-12547
SPACECRAFT COMMUNICATION
Space communications — conferences
N80-12216
Performance and impairments in a QPSK satellite to ground link
N80-12218
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
Application of advanced on-board processing concepts to future satellite communications systems
[NASA-CR-159682] N80-12260
Application of advanced on-board processing concepts to future satellite communications systems: Bibliography
[NASA-CR-159684] N80-12261
SPACECRAFT ENVIRONMENTS
Evaluation and comparison of alternative designs for water/solid-waste processing systems for spacecraft
[NASA-CR-162492] N80-12739
SPACECRAFT ORBITS
Analytic theory of orbit construction and ballistic entry into planetary atmospheres
N80-12978
SPACECRAFT TRACKING
The ATS6 radio beacon pointing data: October 1975 - January 1976
[PB-297511/3] N80-12112
SPACELAB PAYLOADS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
Spectrometer for the first Spacelab payload
N80-12034
SPECIFIC HEAT
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916
Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925
SPECKLE PATTERNS
Optical fringe analysis techniques, volume 1
[AD-A072714] N80-12948
SPECTRAL RECONNAISSANCE
Application of a hierarchial classification method for special problems — correcting direction dependent variations in recorded signals
N80-12502
Digital processing procedure for texture analysis with remote sensing data
N80-12505
Preliminary results on the use of digital methods with center of gravity data reduction in a pre-Alp test region
N80-12509
Determinational of spectral signatures by radiometric ground measurements [realization and problems]
N80-12511
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
N80-12512
Spectral reflection from agricultural and forest regions during the vegetation period
N80-12513
Determination of the optical properties of the sea in the German bight
N80-12516
SPECTRAL SIGNATURES
Applicability of multicausing techniques in establishing inventories for agricultural farming and forestry
N80-12500
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
N80-12512
Spectral reflection from agricultural and forest regions during the vegetation period
N80-12513
Effect of radiometric parameters on remote sensing images
N80-12514
The multispectral scanner as an instrument for signature determinations
N80-12515
SPECTROSCOPIC ANALYSIS
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-78-XX-95] N80-12938
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941
SPECTROSCOPY
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
Photothermal conversion surface measurements using photoacoustic and photothermal spectroscopies
[IS-M-202] N80-12611
SPECTRUM ANALYSIS
Search algorithms and related techniques for the analysis of spectrometric data
N80-12137
Pathological cases in turbulent field and spectral approach
N80-12321
Routine spectral measurements of infrared radiation from the atmosphere
[LBL-8777] N80-12652
Covariance sequence approximation with applications to spectrum analysis and digital filter design
[AD-A072884] N80-12783
Spectral analysis of time series
[AD-A072921] N80-12788
Holographic spectral analysis
[AD-A072715] N80-12869
X-ray line emission from the Tycho supernova remnant
[NASA-TM-80581] N80-12987
SPECULAR REFLECTION
Specularity measurements for solar materials — using Fourier transform analysis
[PNL-SA-6831-PT-2] N80-12573
SPEECH RECOGNITION
Evaluation of adaptive speech coders under noisy channel conditions
N80-12233
SPHERES
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-12020
Hot spot phenomena in active packed beds
N80-12351
SPHERICAL TANKS
Application of packed beds to energy storage use of latent heat of fusion
N80-12353
SPIN-LATTICE RELAXATION
NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165
SPIN-SPIN COUPLING
Magnetic susceptibility of chromium and its alloys
N80-12155
SPLINE FUNCTIONS
Spline approximations for functional differential equations
[AD-A072763] N80-12785
SPOILERS
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053
SPUTTERING
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-6
[ESA-TT-561] N80-12013
Application of sputtering to the improvement of coatings of superalloys
N80-12017
STABILITY DERIVATIVES
Determination in ground facilites of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12102
STAGNATION FLOW
Viscoelastic radial flow between parallel disks
N80-12309
STANDARDIZATION
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183
STANDARDS
Recent concepts: Their influence on code predictions of shrinkage and creep — in concretes
[PB-298413/6] N80-12238
Dimensions/NBS, volume 63, no. 7/8
[PB-298372/4] N80-12242
A comparison of American and European ultrasonic testing standards
[PB-298809/5] N80-12252
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963
STATIC AERODYNAMIC CHARACTERISTICS
Aeroelasticity from the viewpoint of the designer
N80-12002
STATISTICAL ANALYSIS
Data acquisition systems and data analysis in fluid dynamics
[VKI-LEC-SER-1979-5] N80-12354
Analysis of measured values for the state of stress in the earth's crust
[LBL-7071] N80-12648
Solar-climatic statistical study. Summary report, volume 1
[HCP/T4016-1] N80-12707
Statistical representation of electrocardiographic body surface maps for feature identification data compression and classification
N80-12728
A conditional property of adaptive estimators — Monte Carlo method
[AD-A072991] N80-12790
Statistical inference in Markov chains using the principal of minimum discrimination information
N80-12801
Improved estimations under restricted parameters spaces
N80-12802
One-sided tolerance limits for a broad class of lifetime distributions with applications to data of limited accuracy
[AD-A072936] N80-12806
Statistical methods for evaluating sequential material balance data
[NUREG-CR-0683] N80-12809
Non-markovian theory of strong turbulence — steady state and time dependent statistical analysis of turbulence
N80-12876
STATISTICAL MECHANICS
High-pressure and high-temperature behavior of simple and complex molecular liquids — inert gases, diatomic molecules, hydrocarbons
[UCRL-82129] N80-12839
Statistical mechanics of reacting dense plasmas
[UCRL-81936] N80-12903
Semiclassical statistical mechanics
[LBL-9095] N80-12947
STATISTICAL TESTS
Adaptive procedures in analysis of variance
N80-12795
A comparative study of nonparametric methods in the randomized block design under ordered alternatives
N80-12804
STEADY STATE
Non-markovian theory of strong turbulence — steady state and time dependent statistical analysis of turbulence
N80-12876
A thermodynamic theory of steady-state systems
N80-12946

STEEL STRUCTURES
Inelastic behavior of steel structures subjected to earthquake-induced ground motion
N80-12431

STEELS
Electroless [chemiphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
[PB-298741/0] N80-12141

Materials compatibility in liquid sodium
[HEDL-SA-1559] N80-12147

Large deflection analysis of portal frames
[PB-298741/0] N80-12248

Fracture toughness of steel-aluminum deformation welds
[SAND-78-1736] N80-12419

STEREOPHOTOGRAPHY
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463

STEREOSCOPY
A study in the determination of depth information from underwater acoustical scanners
N80-12458

STIFFNESS
Modified face seal for positive film stiffness
[NASA-CASE-LEW-12909-1] N80-12414

STOCHASTIC PROCESSES
Limiting behaviors of certain continuous time-parameter stochastic processes and their applications — Wiener process
N80-12800

STOKES LAW OF RADIATION
Analysis of Coherent Anti-Stokes Raman Spectra: Determination of molecular parameters
N80-12829

STORAGE STABILITY
Gas sample storage
[PB-298350/0] N80-12152

STORM DAMAGE
Climate and society: Lessons from recent events
N80-12691

STRAIN ENERGY METHODS
On some new general and complementary energy theorems for the rate problems in finite strain, classical elasto-plasticity
[AD-A072969] N80-12444

Rate complementary energy principles finite strain plasticity problems and finite elements
[AD-A072970] N80-12446

STRAIN HARDENING
Structural inelasticity 23: A piecewise linear theory of plasticity for an initially isotropic material in plane stress
[AD-A073008] N80-12445

STRAIN RATE
On some new general and complementary energy theorems for the rate problems in finite strain, classical elasto-plasticity
[AD-A072969] N80-12444

STRATIFICATION
Numerical simulation of collapsing turbulent wakes: Comparison of turbulence closures and numerical schemes
[AD-A072143] N80-12378

STRATOSPHERE
Predictions of the effects on the stratosphere of changes in the oxides of nitrogen
[UCRL-82553] N80-12651

STRATUS CLOUDS
An investigation of the acidity of stratus cloud water and its relationship to droplet distribution, pH of rain, and weather parameters
N80-12616

STREAMLINING
Application of data acquisition systems for on-line definition and control of wind tunnel shape
N80-12356

STRESS ANALYSIS
Design and analysis of single cell balloons — stress analysis of high altitude balloons
[AD-A072828] N80-12068

Stresses in the neighborhood of loaded holes in wood with application to bolted joints
N80-12427

Experimental and theoretical investigation of pipe riser clamps
N80-12428

Development of the substructural element method for stress analysis
N80-12433

Development and application of methods of experimental mechanics — photoelastic and viscoelastic stress analysis
[AD-A072836] N80-12441

Acoustic emission method for stress and strain determination
[AD-A072774] N80-12448

Bond stress-slip relationship and cracking response of reinforced concrete composite
[PB-297744/5] N80-12452

STRESS CONCENTRATION
Acoustic emission method for stress and strain determination
[AD-A072774] N80-12448

STRESS CYCLES
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026

STRESS MEASUREMENT
Acoustic emission method for stress and strain determination
[AD-A072774] N80-12448

Analysis of measured values for the state of stress in the earth's crust
[LBL-7071] N80-12648

Studies of hopping and correlated hopping in p-type germanium by piezo-magneto-resistance measurements — effect of magnetic field and stress on germanium using a piezodielectric gage
N80-12914

STRESS RATIO
A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436

STRONTIUM
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166

STRONTIUM COMPOUNDS
Preparation and comparison of the photoelectric properties of $Sr_2Nb_2O_7$ and $Ba_{0.95}Sr_{0.5}Nb_2O_6$
[AD-A073192] N80-12935

STRUCTURAL ANALYSIS
Modal representation and transfer function of linear dissipative structures
N80-12005

New methods for ground tests of aeronautical structures
N80-12006

Homogenization of static thermoelastic properties of media with periodic structures
N80-12028

A penalty function approach for the nonlinear finite element analysis of thin shells
N80-12432

NASTRAN processing at Johnson Space Center
[NASA-CR-160382] N80-12440

The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907

Na beta-alumina: Structure analysis of a superionic conductor
N80-12924

STRUCTURAL DESIGN
Aeroelasticity from the viewpoint of the designer
N80-12002

Design and analysis of single cell balloons — stress analysis of high altitude balloons
[AD-A072828] N80-12068

STRUCTURAL DESIGN CRITERIA
A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429

STRUCTURAL ENGINEERING
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019

Fundamentals of Regenerators
N80-12347

STRUCTURAL PROPERTIES (GEOLOGY)
Structure of the earth's crust and upper mantle plotted from data of seismic studies
[UCRL-TRANS-11392] N80-12650

STRUCTURAL RELIABILITY
Performance of buried flexible conduits — highways
[PB-298224/7] N80-12250

STRUCTURAL STABILITY
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032

Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143

STRUCTURAL STRAIN
Inelastic behavior of steel structures subjected to earthquake-induced ground motion
N80-12431

STRUCTURAL VIBRATION
Practical aspects of the calculation of structural vibrations
N80-12007

SUBMERGED BODIES
Naval blue-green single-pulse downlink propagation model
[AD-A071780] N80-12406

SUBROUTINES
A collection of equation-solving codes for the CRAY-1 — assembly language
[AD-A073033] N80-12769

SUBSONIC FLOW
Dimensions of a coherent structure in the potential cone of a subsonic free jet
N80-12313

SUBSONIC SPEED
An improved Woodward's panel method for calculating leading-edge and side-edge suction forces at subsonic and supersonic speeds
[NASA-CR-3305] N80-12061

SUBSTRUCTURES
Development of the substructural element method for stress analysis
N80-12433

SULFATES
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605

SULFONATES
Ion electrodes selective for organic functional groups
N80-12114

SULFUR
X-ray diffraction study of the alloy system $Sm_xP_{(x/3)}(1-x)$
N80-12926

SULFUR DIOXIDES
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620

SULFUR OXIDES
Investigations of the safety of Li/SOCl sub 2 batteries
[AD-A072862] N80-12935

SUMMER
Summer weather on Haleakala, Maui
[UHMET-79-09] N80-12708

Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712

SUNLIGHT
Combined effects of polycyclic aromatic hydrocarbons and sunlight — on Chinese hamster V79 cells
[CONF-790447-4] N80-12631

SUPERCONDUCTING MAGNETS
The experimental superconducting synchrotron [ESCAR]
[LBL-8211] N80-12836

Superconducting magnets for mirror machines
[UCRL-81578] N80-12892

SUPERCONDUCTORS
Design and development of an ultra-thin solenoid for a high energy physics particle detector
[CONF-780952-28] N80-12288

Argonne program to assess superconducting stability
[CONF-781055-3] N80-12295

Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912

Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923

Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925

SUPERCRITICAL WINGS
An artificial viscosity method for the design of supercritical airfoils
N80-12051

Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 1: Data analysis
[NASA-CR-2214] N80-12054

Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 2: Test data
[NASA-CR-2215] N80-12055

SUPERFLUIDITY
Superfluid helium three: Some hydrodynamic measurements
N80-12131

SUPERHIGH FREQUENCIES
Communications technology in the 10 to 40 gigahertz frequency band
[PB-297221/4] N80-12275

SUPERNOVA REMNANTS
Detection of a fast, intense and unusual gamma ray transient
[NASA-TM-80570] N80-12983

SUPERNOVAE
X-ray line emission from the Tycho supernova remnant
[NASA-TM-80581] N80-12987

SUPERSONIC AIRCRAFT
Application of supersonic linear theory and hypersonic impact methods to three nonslender hypersonic airplane concepts at Mach numbers from 1.10 to 2.86
[NASA-TP-1539] N80-12063

SUPERSONIC COMBUSTION RAMJET ENGINES
Supersonic combustion, air dissociation through shock waves and aerodynamics of chemically reacting gases in a Planar converging - diverging nozzles — supersonic combustion ramjet engines
[AD-A073135] N80-12097

SUPERSONIC DRAG
Prediction of drag coefficients of a supersonic V/STOL configuration with various store arrangements
[AD-A072999] N80-12085

SUPERSONIC FLOW
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015

Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-intakes
N80-12038

A generalized base-flow analysis with initial boundary-layer and chemistry effects
[AD-A072663] N80-12377
SUPERSONIC JET FLOW
Shock tube research looking at the origin of the Machwaves inside and outside supersonic jets
N80-12211
Laser nanometer measurements in a supersonic free jet with a hot gaseous envelope
N80-12312
SUPERSONIC SPEEDS
An improved Woodward's panel method for calculating leading-edge and side-edge suction forces at subsonic and supersonic speeds
[NASA-CR-3205] N80-12061
Pitot pressure measurements in flow fields behind circular-arc nozzles with exhaust jets at subsonic free-stream Mach numbers — Imgley 16 foot transonic tunnel
[NASA-TM-80169] N80-12066
SUPERSONIC WIND TUNNELS
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-12036
Construction problems for high Reynolds number wind tunnel models
[ESA-TT-564] N80-12101
SUPERSONICS
Application of supersonic linear theory and hypersonic impact methods to three semileader hypersonic airplane concepts at Mach numbers from 1.10 to 2.86
[NASA-TP-1539] N80-12065
SUPPORTS
Experimental and theoretical investigation of pipe riser clamps
N80-12428
SURFACE DEFECTS
Replication technique for examining defects in the interface of a metal-to-glass ceramic bond
[GEPP-TIS-391] N80-12182
SURFACE FINISHING
Abrasive machining of major components
[AD-A071916] N80-12415
SURFACE NAVIGATION
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation — surface navigation
[AD-A073153] N80-12081
SURFACE PROPERTIES
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-12020
Texture analysis by means of synthetic impulse functions
N80-12466
Studies in surface structure by means of surface viscosity
N80-12908
SURFACE ROUGHNESS
Mixing length model for compressible turbulent flows in rough channels
N80-12044
Theoretical analysis of scattering of a laser beam from rough surfaces
[AD-A073129] N80-12871
SURFACE TEMPERATURE
Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12488
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
SURFACE VEHICLES
Electromagnetic interference [EMI] radiative measurements for automotive applications
[PB-298605/7] N80-12276
SURFACE WATER
Using surface waters for supplementing injection at the Salton Sea Geothermal Field [SSGF], Southern California
[UCRL-83011] N80-12561
SURFACE WAVES
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
SURFACES
Lifting surface divergence and control effectiveness
N80-12004
SURGES
Rotating stall and surge in axial compressors
N80-12328
Steady pressure distortion
N80-12330
SUSPENSIONS
Pressure drop and heat transfer in concurrent downflow of gas-solids suspensions
N80-12308
SWEDEN
Effects of energy policy on industry
[USFFE-1978-8] N80-12804
SWEPT WINGS
Lifting surface divergence and control effectiveness
N80-12004
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
SWITCHING CIRCUITS
Space communication — conferences
N80-12216
Reliability performances of systems with a switching matrix
N80-12217
Line Access Test System [LATS]
[AD-A072768] N80-12750
SYMBOLIC PROGRAMMING
Subjective understanding: Computer models of belief systems
N80-12764
SYMBOLS
Rational ways to increase pictographic symbol discriminability
N80-12734
SYNCHRONISM
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
SYNCHROTRONS
The experimental superconducting synchrotron [ESCAR]
[LBL-8211] N80-12836
SYNTHANE
Environmental assessment report: Lurgi coal gasification systems for SNG
[PB-296109/0] N80-12204
SYNTHETIC APERTURES
An approach to blocked aperture synthesis
N80-12222
SYNTHETIC FUELS
LASL thermochemical hydrogen program status on October 31, 1978 — fusion-synfuel
[LA-UR-78-2895] N80-12197
Status of the PEATGAS process
[CONF-781045-3] N80-12199
Environmental aspects of alternative fuels utilization for highway vehicles
[UCRL-81841] N80-12201
SYSTEMS ANALYSIS
Satellite Power Systems [SPS] concept definition study. Volume 4: SPS point design definition
[NASA-CR-150683] N80-12106
Solar power satellite system definition study. Part 1: Midterm briefing
[NASA-CR-160369] N80-12108
NASTRAN processing at Johnson Space Center
[NASA-CR-160382] N80-12440
Systems Analysis and testing [SAT] program
[SERI/PR-35-313] N80-12565
Line Access Test System [LATS]
[AD-A072768] N80-12750
Systems study of Tokamak fusion-fission reactors
[PPPL-1450] N80-12904
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]
[AD-A072947] N80-12950
Level-of-service concepts in urban public transportation
[PB-298849/1] N80-12966
SYSTEMS ENGINEERING
The impact of global positioning system on guidance and controls systems design of military aircraft, volume 1
[AGARD-AR-147-VOL-1] N80-12082
Solar power satellite system definition study. Part 1: Midterm briefing
[NASA-CR-160369] N80-12108
Solar power satellite system definition study, volume 5. Phase 2: Final briefing
[NASA-CR-160380] N80-12109
Heated electron beam cell study
[AD-A072875] N80-12410
Architectural concerns in solar system design and installation
[SOLAR/0801-79-01] N80-12607
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768
Design and performance evaluation for systems in an uncertain environment
[AD-A073207] N80-12777
Reliability and maintainability analysis: A conceptual design model
[AD-A073120] N80-12949
SYSTEMS STABILITY
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032

T

TABLES [DATA]
The 19305AT OSRS, missile number 1040, round number V-43 — meteorological data
[AD-A073188] N80-12705
The 1930AT OSRS, missiles number 1026, 1036, 1034, rounds number V-40, V-41, V-42
[AD-A073187] N80-12706
Tide tables 1980. High and low water predictions, East Coast of North and South America including Greenland
[PB-298726/1] N80-12725
Input and table-handling facility for Fortran programs
[SAND-78-1165] N80-12772
TANGENTS
Some aspects of the local and global theory of Pfaffian systems — cotangent bundle of a smooth manifold
N80-12780
TARGET ACQUISITION
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733
TARGET RECOGNITION
Subsurface electromagnetic target characterization and identification
[AD-A072491] N80-12272
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733
Accuracy of parameter estimates for closely spaced optical targets
[AD-A073093] N80-12870
TEARING
Tearing modes in a plasma with magnetic braiding
[PPPL-1561] N80-12884
TECHNOLOGICAL FORECASTING
Transportation and the future
[PB-298907/7] N80-12964
TECHNOLOGY ASSESSMENT
Technology options for an enhanced air cargo system
[NASA-TM-80173] N80-12076
Ultrapurification of reactive metals
[IS-M-167] N80-12168
The future role of hydrogen fuel in an electrical society
[UTIAS-241] N80-12189
Thermochemical production of hydrogen from water, a critical review
[LA-UR-78-2996] N80-12196
HYGAS process update
[CONF-781045-4] N80-12200
Communications technology in the 10 to 40 gigahertz frequency band
[PB-297221/4] N80-12275
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12460
Search for fusion power
[UCRL-81890] N80-12900
The status of advanced propulsion systems for urban rail vehicles
[PB-297980/5] N80-12962
TECHNOLOGY TRANSFER
An overview of the NASA technology utilization program
N80-12397
Forest resource information system, phase 3
[E80-10026] N80-12528
Baltimore applications project
[NASA-TM-80577] N80-12957
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/0] N80-12961
TECHNOLOGY UTILIZATION
Dimensions/NBS, volume 63, no. 7/8
[PB-298372/4] N80-12242
Orthopedic evaluation
N80-12391
Dental research: Preliminary observations and projections
N80-12392
Dosimetric considerations in dental applications
N80-12393
Maxillo: Facial diagnosis
N80-12394
Pediatrics
N80-12395
Podiatry
N80-12396
An overview of the NASA technology utilization program
N80-12397
Applications of the knowledge of climate
N80-12695
Policy Coordination Group for technology development
[GPO-31-469] N80-12956
Traffic model for commercial payloads in the Materials Experiment Assembly [MEA] — market research in commercial space processing
[NASA-CR-162454] N80-12958

TELECOMMUNICATION
Central Computational Facility CCF communications subsystem options
[NASA-CR-160383] N80-12257
Communications technology in the 10 to 40 gigahertz frequency band
[PB-297221/4] N80-12275
TELEPHONY
Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits
N80-12221
Bit rate reduction by automatic adaptation of quantizer step-size in DPCM systems
N80-12230
TELESCOPES
Measurement of circumsolar radiation: Status report
[LBL-8391] N80-12982
TELEVISION SYSTEMS
Contrast enhancement methods for video systems
[AD-A073076] N80-12264
Advanced digital TV system
[AD-A072917] N80-12274
TEMPERATE REGIONS
Climatic variability and agriculture in the temperate regions
N80-12681
TEMPERATURE DEPENDENCE
Temperature dependent triplet energy processes in aromatic polymers
N80-12176
Lattice dynamics of hcp and bcc zirconium
N80-12930
TEMPERATURE DISTRIBUTION
Velocity and temperature fields in oscillating boundary layers
N80-12306
Temperature distortion — in a compressor inflow
N80-12332
Dynamic response of a packed-bed energy storage system to a time varying inlet temperature
N80-12341
Heat transfer in a column packed with spheres
N80-12343
TEMPERATURE EFFECTS
Blade wake interference: Temperature effect — on cascade flow
N80-12335
An X-ray diffraction study of the thermal vibration of atoms in beta-tin
N80-12918
TEMPERATURE MEASUREMENT
Semiconductor measurement technology: Thermal resistance measurements on power transistors
[PB-298318/7] N80-12301
The measurement of temperature instabilities and their effect on the liquid phase epitaxial growth of gallium arsenide
[ERL-0077-TR] N80-12931
TEMPERATURE PROFILES
Rayleigh temperature profiles in a hydrogen diffusion flame
[SAND-78-8726] N80-12148
TENSILE STRENGTH
Effects of thermal spiking on graphite-epoxy composites
[AD-A072825] N80-12122
Effect of constituent properties on composite strength
[UCRL-82051] N80-12124
TENSOR ANALYSIS
Higher-order boundary layer equations for three-dimensional compressible flow
N80-12048
TERMINAL BALLISTICS
Miscellanea concerning terminal ballistics
N80-12208
The use of holography for kinetic energy measurements of target splinters
N80-12209
TERNARY SYSTEMS
A study of the optical and transport properties of the ternary semiconducting compounds AlxGa1-xAs high pressure
N80-12911
TERRAIN
Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733
TEST FACILITIES
Experimental test facility for evacuation of solar control strategies
[LBL-8308] N80-12586
Mead, Nebraska, 25-kW photovoltaic power system
[COO-4094-10] N80-12592
Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649
High temperature facility for atomic physics studies — test facilities for laser heating high temperature plasmas
[UCRL-13969] N80-12840
TEXAS
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10006] N80-12524
Houston Conference on the Revitalization of the Inner City
[PB-298906/9] N80-12965
TEXTURES
Texture analysis as a recognition parameter for different types of forests
N80-12498
Digital processing procedure for texture analysis with remote sensing data
N80-12505
THALLIUM ALLOYS
Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925
THEMATIC MAPPING
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10006] N80-12524
THEORETICAL PHYSICS
Cosmological tests of a scale covariant theory of gravitation
N80-12976
THERMAL BATTERIES
Batteries for specific solar applications
[SAND-79-1428C] N80-12559
THERMAL CONDUCTIVITY
Fundamentals of Regenerators
N80-12347
THERMAL DIFFUSION
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
THERMAL ENERGY
Fluid Dynamics of Porous Media in Energy Applications, volume 1 — heat storage and transfer in solar energy conversion systems
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
Dynamic response of a packed-bed energy storage system to a time varying inlet temperature
N80-12341
Heat storage and thermal transfer aspects of the dynamic behaviour of a packed bed
N80-12342
THERMAL INSULATION
Preliminary design procedure for insulated structures subjected to transient heating
[NASA-TP-1534] N80-12438
THERMAL MAPPING
Evaluation of thermal images of the Jade region
N80-12475
Water quality in coastal regions: Evaluation of thermal images of factory water coolant inlets
N80-12477
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12488
Thermal images and climatic changes in regrouped vineyards on mountain slopes
N80-12489
Large scale thermal images as a means of distinguishing between building structures in a town
N80-12490
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
Development of processing methods for images of the Jade coast region and experience acquired
N80-12504
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution
[E80-10002] N80-12518
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] N80-12526
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
TELLUS newsletter 1 — Beauce, France
[E80-10029] N80-12531
THERMAL POLLUTION
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
THERMAL PROTECTION
Multiwall thermal protection system
[NASA-CASE-LAR-12620-1] N80-12117
THERMAL RESISTANCE
Semiconductor measurement technology: Thermal resistance measurements on power transistors
[PB-298318/7] N80-12301
THERMAL STRESSES
Effects of thermal spiking on graphite-epoxy composites
[AD-A072825] N80-12122
Reinforcement to control thermal and shrinkage cracking
[PB-298412/8] N80-12237
Thermal stresses in non-homogeneous shells of revolution: Theory and analysis
[IIT-B/CE-79-2] N80-12437
THERMIONIC CONVERTERS
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12980
THERMIONIC EMISSION
Transport theory of carriers across semiconductor heterojunction interfaces
N80-12280
THERMOCHEMISTRY
Thermochemical production of hydrogen from water, a critical review
[LA-UR-78-2996] N80-12196
LASL thermochemical hydrogen program status on October 31, 1978 — fusion-synfuel
[LA-UR-78-2895] N80-12197
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605
THERMODYNAMIC EFFICIENCY
Photothermal conversion surface measurements using photoacoustic and photothermal spectroscopies
[IS-M-202] N80-12611
Comments on the derivation of the Carnot efficiency according to Max Planck: Thermodynamics [eleventh edition] De Gruyter 1964 and R. Claudius: Mechanical heat theory [third edition] Vieweg 1887
[UCRL-TRANS-1572] N80-12948
THERMODYNAMIC EQUILIBRIUM
A generalized base-flow analysis with initial boundary-layer and chemistry effects
[AD-A072683] N80-12377
A thermodynamic theory of steady-state systems
N80-12946
THERMODYNAMIC PROPERTIES
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116
Materials problems in reversible chemical reaction storage systems for solar energy
[SAND-78-8693] N80-12574
Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912
THERMODYNAMICS
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
Thermal-hydraulic considerations in magnetically confined fusion reactors
[GA-A-15365] N80-12896
Current status of fusion reactor blanket thermodynamics
[ANL-78-109] N80-12897
A thermodynamic theory of steady-state systems
N80-12946
Comments on the derivation of the Carnot efficiency according to Max Planck: Thermodynamics [eleventh edition] De Gruyter 1964 and R. Claudius: Mechanical heat theory [third edition] Vieweg 1887
[UCRL-TRANS-1572] N80-12948
THERMOELASTICITY
Homogenization of static thermoelastic properties of media with periodic structures
N80-12028
THERMOELECTRIC POWER GENERATION
Thermoelectric ocean thermal energy conversion
[SERI/TP-35-254] N80-12564
Photothermal conversion of solar energy into electricity
[DOE-TR-159] N80-12612
THERMONUCLEAR REACTIONS
Thermonuclear burn in wall-confined plasmas
[COO-2456-60] N80-12905

THERMOPLASTICITY
A theory of thermoviscoplasticity
N80-12425

THIN FILMS
The sulfurization reaction on refractory thin films: A mechanistic investigation
N80-12129
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
Characterization of thin film microstrip attenuators at microwave frequencies
[BDX-613-1857-REV] N80-12293
Preparation and characterization of hydrogenated amorphous silicon thin films and thin film solar cells produced by ion plating techniques
[SAN-1046-T1] N80-12580

THIN PLATES
Characterization of microchannel plate photomultipliers for plasma diagnostics
[S-129-TP] N80-12891

THIN WALLED SHELLS
The dynamic response of elastic isotropic thin circular cylindrical shells to intense heat
N80-12426
A penalty function approach for the nonlinear finite-element analysis of thin shells
N80-12432
Small-scale yielding at the tip of a through-crack in a shell
[AD-A072832] N80-12442

THREE BODY PROBLEM
Variational Padé approximants applied to the three- and four-body problem
N80-12944

THREE DIMENSIONAL FLOW
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015
Higher-order boundary layer equations for three-dimensional compressible flow
N80-12041
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
The computation of three dimensional viscous flows
N80-12362
Time marching methods for turbomachinery flow calculation — time dependence of flow equations for two and three dimensional flow in turbomachinery
N80-12369

TIDES
Applications of HCMM data to soil moisture survey and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
Tide tables 1980. High and low water predictions. East Coast of North and South America including Greenland
[PB-298726/1] N80-12725

TIMBER IDENTIFICATION
Texture analysis as a recognition parameter for different types of forests
N80-12498
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499

TIMBER INVENTORY
Applicability of multicanning techniques in establishing inventories for agricultural farming and forestry
N80-12500

TIME DEPENDENCE
Time marching methods for turbomachinery flow calculation — time dependence of flow equations for two and three dimensional flow in turbomachinery
N80-12369
Time marching methods for turbomachinery flow calculation: Methods of improving convergence — time dependence and convergence of flow equations in turbomachinery
N80-12370
Time-dependent difference theory for noise propagation in a two-dimensional duct — of a turbofan engine
[NASA-TM-79298] N80-12822
A time dependent difference theory for sound propagation in ducts with flow — characteristic of inlet and exhaust ducts of turbofan engines
[NASA-TM-79302] N80-12823
Non-markovian theory of strong turbulence — steady state and time dependent statistical analysis of turbulence
N80-12876

TIME DIVISION MULTIPLE ACCESS
Synchronization procedures for a regenerative SS-TDMA system
N80-12219

TIME DIVISION MULTIPLEXING
The telecommunication satellite as an integrated time division transmission-switching system
N80-12220

TIME FUNCTIONS
Limiting behaviors of certain continuous time-parameter stochastic processes and their applications — Wiener process
N80-12800

TIME MEASUREMENT
TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873

TIME SERIES ANALYSIS
Wind time series analyses for WECS applications
[SAND-77-1701] N80-12709
Spectral analysis of time series
[AD-A072921] N80-12788
On the relationship between the R and S arrays and the Box-Jenkins method of ARMA model identification
[AD-A072934] N80-12789
Estimation of the order of an autoregressive time series - a Bayesian approach
N80-12803

TIMING DEVICES
The time-of-flight system on the Goddard medium energy gamma-ray telescope
[NASA-TM-80579] N80-12970

TIN
An X-ray diffraction study of the thermal vibration of atoms in beta-tin
N80-12918
Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923

TITAN 3 LAUNCH VEHICLE
Airborne measurements of cloud-forming nuclei and aerosol particles in stabilized ground clouds produced by solid rocket booster firings
[NASA-CR-160357] N80-12663

TITANIUM
Impact damage on titanium leading edges from small soft body objects
[AD-A072705] N80-12095

TOKAMAK DEVICES
Numerical studies of current generation by radio-frequency traveling waves
[PPPL-1506] N80-12296
Transient 3-d eddy current in multiple conductors
[CONF-790730-2] N80-12298
United States magnetic fusion energy program
[DOE/ET-0072] N80-12583
Transport and radiation studies of belt pinches and high-beta Tokamaks
[SAI-78-964-LJ] N80-12887
Volt-second consumption during the startup phase of a large Tokamak
[PPPL-1506] N80-12888
Safety aspects of activation products in a compact Tokamak Fusion Power Plant
[PNL-2823] N80-12893
Developing maintainability for Tokamak fusion power systems, phase 2 report. Volume 2: Study results
[COO-4184-6-VOL-2] N80-12895
Conceptual design of a Demonstration Tokamak Hybrid Reactor [DTHR]
[WFPS-TME-107] N80-12898
Response of a Tokamak plasma to particle and momentum sources
[ORNL/TM-6575] N80-12901
Systems study of Tokamak fusion-fission reactors
[PPPL-1450] N80-12904

TOLERANCES [MECHANICS]
One-sided tolerance limits for a broad class of lifetime distributions with applications to data of limited accuracy
[AD-A072936] N80-12806

TOPOGRAPHY
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519

TORNADOES
Dynamic behavior of single and multiple vortex tornadoes inferred from laboratory simulation
N80-12657

TOROIDAL PLASMAS
Response of a Tokamak plasma to particle and momentum sources
[ORNL/TM-6575] N80-12901

TORSIONAL STRESS
Linear and nonlinear earthquake responses of simple torsionally coupled systems
[PB-298262/7] N80-12450

TORSIONAL VIBRATION
Vibration-torsion interaction in the microwave spectrum of methyl malonaldehyde
N80-12831

TOWERS
The effects of freestream turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239

TRACE ELEMENTS
The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162480] N80-12623

TRACKING [POSITION]
Design and performance evaluation for systems in an uncertain environment
[AD-A073207] N80-12777

TRAFFIC CONTROL
A communications trade-off study for computerized traffic control. Volume 2: Appendixes
[PB-298844/2] N80-12967

TRAJECTORY ANALYSIS
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021

TRANSDUCERS
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12420

TRANSFER FUNCTIONS
Modal representation and transfer function of linear dissipative structures
N80-12005

TRANSIENT HEATING
Preliminary design procedure for insulated structures subjected to transient heating
[NASA-TP-1534] N80-12438

TRANSIENT REACTOR TEST FACILITY
Engineering study of dry near-surface interim storage of fast flux test facility spent fuel
[RHO-LD-66] N80-12858

TRANSISTORS
Semiconductor measurement technology: Thermal resistance measurements on power transistors
[PB-298318/7] N80-12301

TRANSITION METALS
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-822-107] N80-12171
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941

TRANSITION POINTS
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
A computational method for calculating laminar-turbulent transition in a boundary layer
N80-12047

TRANSLATIONAL MOTION
The use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile
N80-12207

TRANSMITTANCE
Airborne measurements of optical atmospheric properties, summary and review 3
[AD-A073121] N80-12645

TRANSMITTERS
Characterization of the Q-switched MOBLAS laser transmitter and its ranging performance relative to a FTM Q-switched system
[NASA-TM-80336] N80-12405

TRANSONIC FLOW
Remarks on the transonic flow past oscillating airfoils
N80-12009
Calculation of transonic flows around wings
N80-12014
Calculation - experiment comparisons of the transonic two-dimensional flow in a high-deflection cascade
N80-12016
Analysis of the separation due to shock wave-turbulent boundary layer interaction in transonic flow
N80-12031
Aeroelastic response analysis of two dimensional, single and two degree of freedom airfoils in low-frequency, small-disturbance unsteady transonic flow
[AD-A073379] N80-12073

TRANSONIC WIND TUNNELS
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062
Transonic wind tunnel tests on a series of two-dimensional aerofoils in a solid wall test section
[ARL/AERO-NOTE-344] N80-12063

TRANSPORT AIRCRAFT
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818

TRANSPORT PROPERTIES
Transport phenomena in packed bed reactors
N80-12339
Survey and description of transport phenomena in packed-beds — for thermal energy storage
N80-12340
Transport phenomena in geological layers measurement of parameters
N80-12344
Description of nonlinear internal wave interactions using Langevin methods
[AD-A069010] N80-12721
Transport and radiation studies of belt pinches and high-beta Tokamaks
[SAI-78-964-LJ] N80-12887
The transport properties of dilute gases in applied fields
N80-12906

A study of the optical and transport properties of the ternary semiconducting compounds AlnGa1-xAs high pressure
N80-12911

TRANSPORT THEORY
Transport theory of carriers across semiconductor heterojunction interfaces
N80-12280

TRANSPORTATION
Performance of plastic packaging for hazardous materials transportation. Part 4: Standardizing permeation measurements
[PB-298047/2] N80-12183
Stabilization and compaction
[PB-298935/8] N80-12344
Transportation and the future
[PB-298907/7] N80-12964

TRAVELING WAVES
Numerical studies of current generation by radio-frequency traveling waves
[PPPL-1506] N80-12296

TREES [MATHEMATICS]
Assessment of procedures and preliminary software design for fault tree synthesis
[UCRL-13919] N80-12773

TREES [PLANTS]
Forest resource information system, phase 3
[E80-10026] N80-12528

TRIANGULATION
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Bundle adjustment with field and self calibration: Recent results
N80-12461
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
Block-adjustment programs for minicomputers
N80-12464

TRIMERS
Ground state energy of molecular trimers
N80-12832

TRIMETHYL COMPOUNDS
The crystal and molecular structure of trimethyltin chloride at 135 K, a highly volatile organotin polymer
[AD-A073644] N80-12180

TRIVALENT IONS
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-78-XX-95] N80-12938

TROPICAL METEOROLOGY
Surface meteorology over the gate a-scale
[REPT-78-4] N80-12658

TROPICAL REGIONS
Climatic variability and agriculture in tropical moist regions
N80-12682
Climatic variability and agriculture in the semi-arid tropics
N80-12683

TRUCKS
Demand for special performance vehicles, 1975 - 2025
[UCRL-13911] N80-12960

TUNGSTEN
Studies of ultrafine metal particles
N80-12156

TURBINE BLADES
Application of sputtering to the improvement of coatings of superalloys
N80-12017
Computation of discrete hole film cooling flow using the Navier-Stokes equations — gas turbine blades
[AD-A073057] N80-12096

TURBINE ENGINES
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079

TURBINE PUMPS
New concepts for converting the energy in low-to medium-temperature liquids, with emphasis on geothermal applications
[UCRL-52583] N80-12570

TURBINES
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12420
Hybrid staging of geothermal energy conversion processes
[UCID-17949] N80-12569
Efforts on the economic analysis of Darrieus vertical axis wind turbines
[SAND-78-1851C] N80-12579

TURBOCOMPRESSORS
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015
Inlet distortion effects in axial compressors
N80-12327
Rotating stall and surge in axial compressors
N80-12328
Unsteady flow in turbomachines, volume 2
[VKI-LEC-SER-1979-1-VOL-2] N80-12331
Temperature distortion — in a compressor inflow
N80-12332
Unsteady pressure distortion — in compressor inflow
N80-12333
Blade wake interference: Temperature effect — on cascade flow
N80-12335
High speed blade-wake interactions — in axial flow turbomachines
N80-12336
Rotating stall in axial flow compressors
N80-12337

TURBOFAN ENGINES
Design, durability and low cost processing technology for composite fan exit guide vanes
[NASA-CR-159677] N80-12091
Time-dependent difference theory for noise propagation in a two-dimensional duct — of a turbofan engine
[NASA-TM-79298] N80-12822
A time dependent difference theory for sound propagation in ducts with flow — characteristic of inlet and exhaust ducts of turbofan engines
[NASA-TM-79302] N80-12823

TURBOJET ENGINES
The criticality of engine exhaust simulations on VSTOL model-measured ground effects
[AD-A073114] N80-13093

TURBOMACHINE BLADES
Impact damage on titanium leading edges from small soft body objects
[AD-A072705] N80-12095

TURBOMACHINERY
Analysis and modelling of the flow within a turbomachine combustor
N80-12924
Unsteady flow in turbomachines, volume 1
[VKI-LEC-SER-1979-1-VOL-1] N80-12325
Introduction to unsteady flows in turbomachines
N80-12326
Turbomachine wake transport and interaction
N80-12329
Steady pressure distortions
N80-12330
Application of Numerical methods to Flow calculations in turbomachines
[VKI-LEC-SER-1979-7] N80-12365
Finite element calculations of turbomachinery flows — analysis of finite element method and flow equations in the fluid mechanics of turbomachinery
N80-12367
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
Time marching methods for turbomachinery flow calculation — time dependence of flow equations for two and three dimensional flow in turbomachinery
N80-12369
Time marching methods for turbomachinery flow calculations: Methods of improving convergence — time dependence and convergence of flow equations in turbomachinery
N80-12370

TURBULENCE
Numerical simulation of collapsing turbulent wakes: Comparison of turbulence closures and numerical schemes
[AD-A072143] N80-12378
Non-markovian theory of strong turbulence — steady state and time dependent statistical analysis of turbulence
N80-12876

TURBULENCE EFFECTS
Influence of turbulence on hydrocarbon combustion in a stirred combustor
[ESA-TT-580] N80-12151
The effects of freestream turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239

TURBULENT BOUNDARY LAYER
Analysis of the separation due to shock wave-turbulent boundary layer interaction in transonic flow
N80-12031
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
Turbulent boundary layers on an airfoil in several adverse pressure gradients
[AD-A072839] N80-12070
Two-dimensional vortical motion
N80-12303
Velocity and temperature fields in oscillating boundary layers
N80-12306
An experimental and analytical study of boundary layers in highly turbulent freestreams
[AD-A073006] N80-12376

TURBULENT DIFFUSION
Flame - a slow-flow combustion model
[AD-A072988] N80-12145
Turbulence models for environmental problems — channel flow and heat, mass, and momentum transport
N80-12319
Turbulent destabilization and saturation of the universal drift mode in a sheared magnetic field — electron mobility in turbulent diffusion in a magnetic field
[ORNL/TM-6620] N80-12815

TURBULENT FLOW
Mixing length model for compressible turbulent flows in rough channels
N80-12044
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
Second order modeling of turbulent flows
N80-12318
Direct numerical simulation of turbulence
N80-12320
Pathological cases in turbulent field and spectral approach
N80-12321
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Models for turbulent flows with variable density and combustion — flame propagation
N80-12323
Computation of water waves
[AD-A072946] N80-12375
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379

TURBULENT JETS
Experimental investigation of large scale structures in turbulent jet mixing layers
N80-12027

TURBULENT MIXING
Models of turbulent combustion for numerical predictions
N80-12324
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379

TWO DIMENSIONAL BODIES
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062

TWO DIMENSIONAL FLOW
Calculation - experiment comparisons of the transonic two-dimensional flow in a high-deflection cascade
N80-12016
Perturbed bifurcation theory for plane Poiseuille flow
N80-12305
Time marching methods for turbomachinery flow calculation — time dependence of flow equations for two and three dimensional flow in turbomachinery
N80-12369

TWO PHASE FLOW
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A073128] N80-12882

U

U-2 AIRCRAFT
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] N80-12535

ULTRAHIGH FREQUENCIES
Communications technology in the 10 to 40 gigahertz frequency band
[PB-297221/4] N80-12275
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] N80-12530

ULTRAPURE METALS
Ultrapurification of reactive metals
[IS-M-167] N80-12168
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294

ULTRASONIC FLAW DETECTION
Optimization of computer automated ultrasonic inspection system
[AD-A072677] N80-12423

ULTRASONIC TESTS
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179
A comparison of American and European ultrasonic testing standards
[PB-298809/5] N80-12252

ULTRASONICS
Ultrasonic velocity and absorption measurements in several binary mixtures with pyridine
N80-12817

ULTRAVIOLET RADIATION
Evaluation of an acoustic technique as a nondestructive method of measuring UV degradation of nylon rip-stop fabric
[AD-A072817] N80-12179

UNDERGROUND STORAGE
Application of porous media to heat storage underground
N80-12345

UNDERGROUND STRUCTURES
Seismic vulnerability, behavior and design of buried pipelines, phase 1
[PB-298269/2] N80-12240
Performance of buried flexible conduits — highways
[PB-298224/7] N80-12250

UNDERWATER ACOUSTICS
A study in the determination of depth information from underwater acoustical scanners
N80-12458
General effects of current and sound-speed variations on shortrange acoustic transmission in cyclonic eddies
[AD-A072765] N80-12826
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827

UNDERWATER COMMUNICATION
Naval blue-green single-pulse downlink propagation model
[AD-A071798] N80-12406

UNITED KINGDOM
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest — Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution — soil moisture and evaporation in Grendon Underwood and Newbury, England
[E80-10022] N80-12525

UNITED STATES OF AMERICA
Identification of a methodology for projecting short-term crude petroleum production in the United States
[DOE/EIA-0103/14] N80-12542
United States magnetic fusion energy program
[DOE/ET-0072] N80-12583
Naturally occuring carbon dioxide sources in the United States. A geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery
[PE-2025-38] N80-12624
Estimates for wet and dry removals contributions to the residence time for atmospheric pollutants in the eastern United States
[SR-0980-6] N80-12626
Natural energy act of 1978: Far western perspective. A study for the US Department of Energy, Federal Region 9
[UCID-17944-REV-1] N80-12955

UNIVAC 1110 COMPUTER
NASTRAN processing at Johnson Space Center
[NASA-CR-160382] N80-12440

UNSTEADY FLOW
Unsteady flow in turbomachines, volume 1
[VKI-LEC-SER-1979-3-VOL-1] N80-12325
Introduction to unsteady flows in turbomachines
N80-12326
Inlet distortion effects in axial compressors
N80-12327
Steady pressure distortion
N80-12330
Unsteady flow in turbomachines, volume 2
[VKI-LEC-SER-1979-3-VOL-2] N80-12331
Temperature distortion — in a compressor inflow
N80-12332
Unsteady pressure distortion — in compressor inflow
N80-12333
High speed blade-wake interactions — in axial flow turbomachines
N80-12336
Rotating stall in axial flow compressors
N80-12337

UNSWEPT WINGS
Lifting surface divergence and control effectiveness
N80-12004

UPGRADING
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190

UPPER STAGE ROCKET ENGINES
Orbit decay analysis of STS upper stage boosters
[NASA-CR-160385] N80-12103

UPPER VOLTA
A photovoltaic power system in the remote African village of Tangaye, Upper Volta
[NASA-TM-79318] N80-12552

UPWELLING WATER
Analysis of coastal upwelling and the production of a biomass
[NASA-TM-78614] N80-12720

URANIUM 233
Economics of fusion driven symbiotic energy systems
[CONF-790602-50] N80-12602

URBAN DEVELOPMENT
Future remote sensing tasks in regional planning
N80-12484
Interpretation of IR and MSS data for town areas
N80-12485

URBAN PLANNING
Large scale thermal images as a means of distinguishing between building structures in a town
N80-12490

URBAN RESEARCH
Baltimore applications project
[NASA-TM-80577] N80-12957
Level-of-service concepts in urban public transportation
[PB-298049/1] N80-12966
Implementing packages of congestion-reducing techniques: Strategies for dealing with institutional problems of cooperative programs — project planning for urban transportation
[PB-298831/9] N80-12969

URBAN TRANSPORTATION
The status of advanced propulsion systems for urban rail vehicles
[PB-297980/5] N80-12962
Level-of-service concepts in urban public transportation
[PB-298049/1] N80-12966
Implementing packages of congestion-reducing techniques: Strategies for dealing with institutional problems of cooperative programs — project planning for urban transportation
[PB-298831/9] N80-12969

URETHANES
The kinetics of hydrolytic aging of polyester urethane elastomers
[AD-A072855] N80-12177

USER MANUALS (COMPUTER PROGRAMS)
Research study: Device technology STAR router user's guide — automated layout of large scale integration discretionary interconnection masks
[NASA-CR-161213] N80-12765
Programming in HAL/S
[NASA-CR-162501] N80-12766
User's manual for the magnetohydrodynamic generator channel code, MHDCHN
[SAND-78-1260] N80-12894

USER REQUIREMENTS
The determination of land usages for planning and cartography
N80-12517
Building and exploiting user models
N80-12743

V

V/STOL AIRCRAFT
Prediction of drag coefficients of a supersonic V/STOL configuration with various store arrangements
[AD-A072999] N80-12085
The performance of a conceptual vertical attitude takeoff and landing fighter aircraft
[AD-A073100] N80-12086
The criticality of engine exhaust simulations on VSTOL model-measured ground effects
[AD-A073114] N80-12093
V/STOL flight simulation
[NASA-TM-81156] N80-12100

VACANCIES (CRYSTAL DEFECTS)
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941

VANADIUM COMPOUNDS
Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912

VARIABILITY
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669

VARIATIONAL PRINCIPLES
Linear extremal problems in the class of univalent functions
N80-12779

VEGETATION
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
N80-12512
Remote estimation of surface moisture over a wetshed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527

VEGETATION GROWTH
Preliminary analysis on the potential value of LANDSAT images for a desertification study — Bahia, Brazil
[E80-10003] N80-12519
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor — Southwest Texas
[E80-10008] N80-12524
TELLUS newsletter 1 — Beauce, France
[E80-10029] N80-12531

VELOCITY DISTRIBUTION
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio — numerical analysis of mathematical models of velocity distribution and cascade flow for turbomachinery compressors
N80-12368
Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12814
Theoretical light and velocity curves for Cepheid variables
[LA-7596-MS] N80-12971
Analysis of lunar seismic signals: Determination of instrumental parameters and seismic velocity distribution
[NASA-CR-162603] N80-12980

VELOCITY MEASUREMENT
An investigation of separated flow about a hemisphere-cylinder at 0- to 19- degree in the Mach number range from 0.6 to 1.5
[AD-A073451] N80-12074
Velocity measurements on propellant gases in gun tubes
N80-12311
Application of data acquisition system for on site measurements of wind effects on structures
N80-12357
Recent automation changes in model velocity analyses and data acquisition by miniature price meters
[AD-A072692] N80-12751

VENTILATION
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629

VERTICAL DISTRIBUTION
Analysis of measured values for the state of stress in the earth's crust
[LBL-7071] N80-12648

VIBRATION
The method of weighted residuals in the time domain applied to nonlinear vibrations
[NAL-TR-564T] N80-12435

VIBRATIONAL SPECTRA
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404

VINEYARDS
Thermal images and climatic changes in regrouped vineyards on mountain slopes
N80-12489

VINYL POLYMERS
Temperature dependent triplet energy processes in aromatic polymers
N80-12176

VISCOELASTICITY
Viscoelastic radial flow between parallel disks
N80-12309
Development and application of methods of experimental mechanics — photoelastic and viscoelastic stress analysis
[AD-A072836] N80-12441

VISCOPLASTICITY
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
A theory of thermoviscoplasticity
N80-12425

VISCOSITY
Studies in surface structure by means of surface viscosity
N80-12908

VISCOUS DRAG
An artificial viscosity method for the design of supercritical airfoils
N80-12051

VISCOUS FLOW
Perturbed bifurcation theory for plane Poiseuille flow
N80-12305
The computation of three dimensional viscous flows
N80-12362
The numerical treatment of compressible high Reynolds number flows
N80-12364
Computational aspects of viscous flows — numerical analysis of viscous flow and the relationship of the boundary layer equations to the navier-stokes equation
N80-12371
A simplified model for the viscous crossflow in a slotted test section
[NASA-CR-3206] N80-12372

VISUAL DISCRIMINATION
Detection of different target types in realistic terrain — visual air to ground recognition
[AD-A072973] N80-12733

VLASOV EQUATIONS
Oscillations and waves in anisotropic plasmas — are analyzed using Vlasov and Maxwell equations
N80-12878
VOLTAGE GENERATORS
Microprocessor-controlled, programmable ramp voltage generator
[SAND-79-8040] N80-12289
VORTICES
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
A method for assessing the impact of wake vortices of USAF operations
[AD-A072967] N80-12072
Two-dimensional vortical motion
N80-12303
Dynamic behavior of single and multiple vortex tornadoes inferred from laboratory simulation
N80-12657
General effects of current and sound-speed variations on shortrange acoustic transmission in cyclonic eddies
[AD-A072765] N80-12826
Convective cells and their relationship to vortex diffusion in the Wisconsin levitated octupole — study of plasma potential structure or vortices to determine plasma diffusion
N80-12877
VORTICITY TRANSPORT HYPOTHESIS
Second order modeling of turbulent flows
N80-12318
VULNERABILITY
The infinite parallel-wire array over a ground plane: A code for an EMP vulnerability assessment and hardening program
[AD-A073103] N80-12770

W

WAKES
Wake studies related to reentrant pyramids
[AD-A073825] N80-12105
Turbomachine wake transport and interaction
N80-12329
Blade wake interference: Temperature effect — on cascade flow
N80-12335
High speed blade-wake interactions — in axial flow turbomachines
N80-12336
Numerical simulation of collapsing turbulent wakes: Comparison of turbulence closures and numerical schemes
[AD-A072143] N80-12378
WALL FLOW
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062
WASHINGTON
Aids for forecasting minimum temperature in the Wenatchee frost district
[PB-298339/3] N80-12713
The influence of cloudiness on summertime temperatures in the eastern Washington fire weather district
[PB-298674/3] N80-12716
WASTE DISPOSAL
World Energy Data System [WENDS]. Volume II: Nuclear fission program summaries
[ANL-PMS-79-2-VOL-11] N80-12562
Suggested nuclear waste management radiological performance objectives
[NUREG-CR-0579] N80-12855
Engineering study of dry near-surface interim storage of fast flux test facility spent fuel
[RHO-LD-66] N80-12858
Actinide cross section data and inertial confinement fusion for long term waste disposal
[UCRL-82177] N80-12859
Preliminary area selection considerations for radioactive waste repositories in bedded salt
[UCID-18122] N80-12860
WASTE ENERGY UTILIZATION
Waste heat rejection from geothermal power stations
[ORNL/TM-6533] N80-12575
WASTE TREATMENT
Evaluation and comparison of alternative designs for water/solid-waste processing systems for spacecraft
[NASA-CR-162492] N80-12739
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation — risk and radiation dosage
[UCRL-13917-VOL-1] N80-12856
Evaluation of a developmental heavy metals waste treatment system
[AD-A073131] N80-12959
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963
WASTE UTILIZATION
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3548-01] N80-12587
WASTE WATER
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620
Evaluation of a developmental heavy metals waste treatment system
[AD-A073131] N80-12959
WATER
Thermochemical production of hydrogen from water, a critical review
[LA-UR-78-2996] N80-12196
WATER COOLED REACTORS
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12430
WATER CURRENTS
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
WATER FLOW
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190
Application of a method for comparing one-dimensional and two-dimensional models of a ground-water flow system
[UCRL-52541] N80-12545
WATER HEATING
Assist of an air-to-air heat pump using solar heated hot water
N80-12413
Double-exposure collector system
[TID-28964] N80-12593
Research and development of a heat and pump water heater, volume I
[ORNL/SUB-7321-1] N80-12613
WATER MANAGEMENT
Climate variability and the design and operation of water resource systems
N80-12678
WATER POLLUTION
Environmental assessment report: Lurgi coal gasification systems for SNG
[PB-298109/5] N80-12204
Transport phenomena in geological layers measurement of parameters
N80-12344
Research into determining chemical parameters at the surface of the sea by remote sensing
N80-12479
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution
[E80-10002] N80-12518
Assessing man's impact on wetlands
[PB-298736/0] N80-12634
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963
WATER QUALITY
Water quality in coastal regions: Evaluation of thermal images of factory water coolant inlets
N80-12477
Interpretation of water quality using remote sensing techniques
N80-12493
WATER RESOURCES
Guidelines for the use of structural versus regression analysis in geomorphic studies
[PB-298360/9] N80-12655
Climate variability and the design and operation of water resource systems
N80-12678
WATER TEMPERATURE
Numerical treatment of IR thermal data for the German Bight test region
N80-12474
Evaluation of thermal images of the Jade region
N80-12475
Applications of HCMM data to soil moisture snow and estuarine current studies — soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] N80-12520
WATER TREATMENT
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3548-01] N80-12587
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160280] N80-12620
Purification of waters discharged from Polish lignite mines
[PB-297466/5] N80-12636
WATER VAPOR
An investigation of the acidity of stratus cloud water and its relationship to droplet distribution, pH of rain, and weather parameters
N80-12616
WATER WAVES
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Computation of water waves
[AD-A072944] N80-12375
WATERSHEDS
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data — Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10006] N80-12522
Remote estimation of surface moisture over a watershed — Goodwater Creek Watershed, Missouri
[E80-10025] N80-12527
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] N80-12547
WAVE ATTENUATION
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827
WAVE EQUATIONS
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
WAVE EXCITATION
Experimental and numerical results on a shear layer excited by a sound pulse
[NASA-TM-80183] N80-12821
WAVE FUNCTIONS
Hydrodynamic model wavefunctions in intrinsic coordinates and their application to the structure of even-even nuclei
[IS-T-425] N80-12847
WAVE INTERACTION
Applications of random-choice method to problems in shock and detonation-wave dynamics
[UTIAS-240] N80-12373
WAVE PROPAGATION
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827
WAVE REFLECTION
Reciprocity principle in duct acoustics
[NASA-TM-79300] N80-12824
Helicopter canopy internal reflection investigation
[AD-A073084] N80-12867
WAVEGUIDE TUNERS
Guided wave acoustooptic devices for wideband real-time signal processing
N80-12253
WEAR
Improved capabilities to detect incipient bearing failures
[AD-A073123] N80-12416
WEAR TESTS
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer — for use in water cooled reactors
[LTR-141-101] N80-12430
WEATHER
Summer weather on Haleakala, Maui
[UHMET-79-09] N80-12708
WEATHER FORECASTING
Sierra Cooperative Project [SCPP] forecasting support, volume 1 — for enhancement of winter precipitation
[PB-298497/9] N80-12714
Comparison of LFM and MFM precipitation guidance for Nevada during dorren
[PB-298613/1] N80-12715
The influence of cloudiness on summertime temperatures in the eastern Washington fire weather district
[PB-298674/3] N80-12716
WEATHER MODIFICATION
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12660
Position paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12662
WEIGHTLESSNESS
Future progress in the development of the Lixiscope
N80-12386
WELDABILITY
Weldability of electroformed nickel
[Y-2171] N80-12172
WELDED JOINTS
Austenitic stainless steel-to-ferritic steel transition joint welding for elevated temperature service
[CONF-781068-1] N80-12417
WELDED STRUCTURES
Evaluation of high chromium overplays to protect less alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163
WELDING
Fracture toughness of steel-aluminum deformation welds
[SAND-78-1736] N80-12419

WETLANDS
Assessing man's impact on wetlands
[PB-296736/0] N80-12634
The first five years of coastal zone management
[PB-298780/7] N80-12723
WHEAT
A study of the tolerance block approach to special stratification — winter wheat in Kansas
[E80-10027] N80-12529
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field
[NASA-TM-80320] N80-12532
WHITE NOISE
Determination of noise equivalent reflectance for a multispectral scanner: A scanner sensitivity study
[NASA-TP-1575] N80-12399
WIDEBAND COMMUNICATION
Guided wave acoustooptic devices for wideband real-time signal processing
N80-12253
Application of advanced on-board processing concepts to future satellite communications systems
[NASA-CR-159682] N80-12260
Application of advanced on-board processing concepts to future satellite communications systems: Bibliography
[NASA-CR-159684] N80-12261
WIND [METEOROLOGY]
Wind resource analysis
[SERI/TR-36-088] N80-12710
WIND EFFECTS
Trestle wind tunnel study
[AD-A072791] N80-12069
Application of data acquisition systems for on site measurements of wind effects on structures
N80-12357
WIND MEASUREMENT
Wind study for high altitude platform design
[NASA-RP-1044] N80-12661
The 14818C Lance, missile number 3396, round number 333 APL
[AD-A073109] N80-12701
The 19702A GSRS, missile number 302, round number B-20
[AD-A073111] N80-12703
WIND TUNNEL MODELS
Wind tunnel flutter investigations
N80-12011
Construction problems for high Reynolds number wind tunnel models
[ESA-TT-564] N80-12101
WIND TUNNEL TESTS
Wind tunnel flutter investigations
N80-12011
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Contributions to gas dynamics and aerodynamics
[ESA-TT-518] N80-12035
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-12036
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
Flow field investigations in corner regions in hypersonic flow
N80-12040
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053
Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 1: Data analysis
[NASA-CR-2214] N80-12054
Two-dimensional wind-tunnel tests of a NASA supercritical airfoil with various high-lift systems. Volume 2: Test data
[NASA-CR-2215] N80-12055
Wind tunnel investigation of an oblique wing transport model at mach numbers between 0.6 and 1.4
[NASA-CR-137697] N80-12059
Rotary balance data for a typical single-engine general aviation design for an angle-of-attack range of 8 degrees to 35 degrees. 3. Effect of wing leading-edge modifications, model A
[NASA-CR-3102] N80-12060
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062
Transonic wind tunnel tests on a series of two-dimensional aerofoils in a solid wall test section
[ARL/AERO-NOTE-384] N80-12063
Aerodynamic characteristics of a hypersonic research airplane concept having a 70 deg sweept double-delta wing at Mach numbers from 0.80 to 1.20, with summary of data from 0.20 to 6.0 — Langley 8-ft transonic wind tunnel
[NASA-TP-1552] N80-12064
Trestle wind tunnel study
[AD-A072791] N80-12069
An investigation of separated flow about a hemisphere-cylinder at 0- to 19- degree in the Mach number range from 0.6 to 1.5
[AD-A073451] N80-12074
Determination in ground facilities of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12102
WIND TUNNEL WALLS
Application of data acquisition systems for on-line definition and control of wind tunnel shape
N80-12356
WIND VARIATIONS
Solar-climatic statistical study. Summary report, volume I
[HCP/T4016-1] N80-12707
WINDPOWER UTILIZATION
Efforts on the economic analysis of Darrieus vertical axis wind turbines
[SAND-78-1851C] N80-12579
Solar mechanical energy storage project
[SAND-78-1902C] N80-12590
Solar-climatic statistical study. Summary report, volume I
[HCP/T4016-1] N80-12707
Wind time series analyses for WECS applications
[SAND-77-1701] N80-12709
Wind resource analysis
[SERI/TR-36-088] N80-12710
WINDS ALOFT
Wind study for high altitude platform design
[NASA-RP-1044] N80-12661
WINTER
Sierra Cooperative Project [SCPP] forecasting support, volume 1 — for enhancement of winter precipitation
[PB-298497/9] N80-12714
WOOD
Stresses in the neighborhood of loaded holes in wood with application to bolted joints
N80-12427
WORLD METEOROLOGICAL ORGANIZATION
On climate and mankind — conference, Geneva, Feb. 1979
[WMO-537] N80-12665
WYOMING
Geologic application of thermal-inertia mapping from satellite — Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] N80-12521

X

X RAY DIFFRACTION
Method of analysis and precision of X-ray diffraction data from Ohio shale — used in geological survey of black shales
[METC/CR-78/16] N80-12541
An X-ray diffraction study of the thermal vibration of atoms in beta-tin
N80-12918
X-ray diffraction study of the alloy system $SmF_{[x]}S_{[1-x]}$
N80-12926
X RAY IMAGERY
Preliminary applications and evaluation results. Lixicope: Proceedings of the Lixicope Conference
[NASA-CP-2112] N80-12384
The Lixicope concept
N80-12385
Future progress in the development of the Lixicope
N80-12386
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
X-ray source characteristics and detection efficiencies of prototype Lixicopes
N80-12388
Some contemplated improvements to the prototype Lixicope
N80-12389
A comparison of the Lixicope with other X-ray imaging systems
N80-12390
Orthopedic evaluation
N80-12391
Dental research: Preliminary observations and projections
N80-12392
Dosimetric considerations in dental applications
N80-12393
Maxillo: Facial diagnosis
N80-12394
Pediatrics
N80-12395
Podiatry
N80-12396
X RAY SOURCES
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
X-ray source characteristics and detection efficiencies of prototype Lixicopes
N80-12388
X-ray line emission from the Tycho supernova remnant
[NASA-TM-80581] N80-12987
Detection of high energy X-rays from the galactic center region
[NASA-TM-80584] N80-12988
X RAY SPECTRA
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
X-ray line emission from the Tycho supernova remnant
[NASA-TM-80581] N80-12987
Detection of high energy X-rays from the galactic center region
[NASA-TM-80584] N80-12988
Implications of cyclotron features in the X-ray spectrum of Her X-1
[NASA-TM-80588] N80-12989
X RAYS
X-ray emission in heavy-ion collision
[ORO-4036-1] N80-12843
X-ray line emission from the Tycho supernova remnant
[NASA-TM-80581] N80-12987
XENON
Operation of a high-current xenon source
[LBL-8859] N80-12149

Y

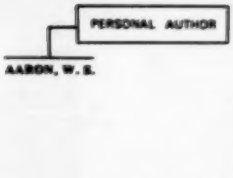
YAG LASERS
Characterization of the Q-switched MOBLAS laser transmitter and its ranging performance relative to a PTM Q-switched system
[NASA-TM-80336] N80-12405
YIELD POINT
Structural inelasticity 23: A piecewise linear theory of plasticity for an initially isotropic material in plane stress
[AD-A073008] N80-12445

Z

ZINC
Auger electron spectroscopy studies of oxide films on Al-Zn-Mg alloys
[AD-A073096] N80-12161
ZIRCALOYS [TRADEMARK]
Oxidation and embrittlement of zircaloy-4 cladding from high temperature film boiling operation
[TFBP-TR-292] N80-12164
ZIRCONIUM
Lattice dynamics of hcp and bcc zirconium
N80-12930

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABER, J. D. N80-12630
ABLOW, C. M. N80-12787
ABRAHAM, K. M. N80-12555
ABRAHAM, R. G. N80-12961
ACHENBACH, J. D. N80-12442
N80-12443
ACKERMAN, M. N80-12034
ACKERMANN, F. N80-12456
ADAMS, J. W. N80-12276
ADAMS, T. F. N80-12971
ADELMAN, H. M. N80-12438
AHLGREN, D. C. N80-12919
AHMED, S. M. N80-12115
AHRENS, D. N80-12487
AITKEN, R. G. N80-12916
AKYLAS, V. R. N80-12844
ALA, G. G. N80-12663
ALBERTZ, J. N80-12467
ALBRIGHT, C. E. N80-12419
ALBRIGHT, D. E. N80-12968
ALCORTA, J. A. N80-12416
ALEXANDER, S. S. N80-12551
ALEXANDER, W. K. N80-12059
ALKER, K. N80-12166
ALLEN, J. H. N80-12653
ALLEN, M. A. N80-12258
AMADESI, P. N80-12218
AMES, W. G. N80-12769
AMIMOTO, S. T. N80-12134
AMTHOR, F. R. N80-12613
ANANIA, G. L. N80-12185
ANDERSON, C. J. N80-12201
ANDERSON, D. L. N80-12644
ANDERSON, J. N80-12387
ANDERSON, J. J. N80-12950
ANDERSON, L. R. N80-12056
ANDERSON, M. A. N80-12963
ANDERSON, N. C. N80-12409
ANDERSON, R. D. N80-12406
ANDERSON, T. G. N80-12135
ANDRES, R. O. N80-12729
ANDREWS, E. H. N80-12178
ANICICH, V. G. N80-12851
ARGYRAKIS, P. N80-12920
ARMAND, C. N80-12030
ARMINGTON, K. N80-12578
ARTHUR, M. D. N80-12878
ARTHUR, M. G. N80-12279
ASSADI, A. H. N80-12778
ATKINSON, L. P. N80-12535
ATLURI, S. N. N80-12444
N80-12446
AUSTIN, A. L. N80-12570
AVILES, R. G. N80-12176
AZEVEDO, L. J. N80-12165

B

BABCOCK, C. D. N80-12236
BABUSKA, I. N80-12793
BAE, M. S. N80-12915
BAEHR, H. P. N80-12457
N80-12472
BAETE, J. N80-12042
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BAIRD, C. A. N80-12266
BAKER, R. D. N80-12654
BALASUBRAHMANYAN, V. K. N80-12984
BALCOMB, J. D. N80-12577
BALL, K. O. W. N80-12111
BALLATO, A. N80-12825
N80-12936
BANKS, H. T. N80-12765
BARBER, J. P. N80-12095
BARD, J. F. N80-12767
BARDELMEIER, L. N80-12968
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BARLOW, T. M. N80-12596
BARNES, J. D. N80-12183
BARRETT, D. L. N80-12285
BARTELS, H. N80-12486
BARTHEL, H. O. N80-12146
BARTHOLDI, M. F. N80-12665
BATHKE, C. G. N80-12904
BAUDIN, G. N80-12018
BAUER, F. N80-12212
BAUMEISTER, K. J. N80-12822
N80-12823
BAUMGARDNER, R. N80-12633
BAUMGARTNER, A. N80-12687
BAYLISS, A. N80-12821
BAZIN, M. N80-12101
BEALL, J. H. N80-12988
BEAMISH, J. K. N80-12059
BECKER, G. N80-12474
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BECKETT, J., III N80-12783
BEEX, A. A. N80-12153
BEIMER, R. G. N80-12827
BELL, D. W. N80-12726
BELLEHSEN, D. M. N80-12152
BELTIS, K. N80-12663
BENDURA, R. J. N80-12564
BENSON, D. K. N80-12447
BENZLEY, S. E. N80-12589
BERDAHL, P. N80-12652
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BERMAN, B. L. N80-12856
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BERNARD, A. N80-12944
BERNARDI, E. R. N80-12402
BERNER, A. N80-12374
BERSHADER, D. N80-12597
BERT, C. W. N80-12788
BERTAPELLE, A. L. N80-12451
BERTERO, V. V. N80-12095
BERTKE, R. S. N80-12034
BESSON, J. N80-12646
BHADRA, K. N80-12023
BIAUSSE, D. N80-12893
BICKFORD, W. E. N80-12939
BIEFELD, R. M. N80-12222
BIELLI, P. N80-12223
N80-12224
N80-12228
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BIFANO, W. J. N80-12060
BIHRLE, W., JR. N80-12526
BIJLEVELD, J. H. N80-12921
BINDER, M. N80-12565
BISHOP, C. J. N80-12599
BJORNSTAD, D. J. N80-12059
BLACK, R. L. N80-12535
BLAINE, L. R. N80-12376
BLAIR, M. F. N80-12091
BLECHERMAN, S. S. N80-12290
BLESSNER, P. L. N80-12378
BLOCK, J. N80-12557
BLURTON, K. F. N80-12526
BLYTH, K. N80-12511
BOEHNEL, H. J. N80-12904
BOHLKE, W. H. N80-12564
BOHN, M. S. N80-12888
BOL, K. N80-12794
BOLEY, D. L. N80-12668
BOLIN, B. N80-12662
BOLLAY, E. N80-12567
BONNER, J. N80-12151
BONNIOT, C. N80-12324
BORGHI, R. N80-12145
BORIS, J. P. N80-12662
BOSART, L. N80-12936
BOSCO, C. D. N80-12862
BOSE, S. K. N80-12630
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BOTT, G. N80-12079
BOTTERI, B. P. N80-12033
BOUDON, Y. N80-12625
BOWMAN, B. R. N80-12635
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BOWMAN, M. G. N80-12085
BOYD, T. H. N80-12347
BRASZ, J. N80-12348
N80-12707
BRAY, R. E. N80-12147
BREHM, W. F. N80-12236
BRENNEN, C. N80-12334
BREUGELMANS, F. A. E. N80-12335
N80-12007
BREVAN, J. P. N80-12248
BRIDGE, R. Q. N80-12439
N80-12089
BRIDGMAN, M. N80-12096
BRILEY, W. R. N80-12432
BROCKMAN, R. A. N80-12808
BROFFITT, J. D. N80-12966
BROGAN, J. N80-12576
BROHL, E. C. N80-12177
BROWN, D. W. N80-12379
BROWN, G. L. N80-12779
BROWN, J. E. N80-12387
BROWN, S. N80-12656
BROWNING, G. L. N80-12774
BRUCKNER, L. A. N80-12780
BRYANT, R. L. N80-12442
BUBENIK, T. N80-12904
BUCHANAN, C. H. N80-12351
BUCHLIN, J. M. N80-12352
N80-12353
BUDENSTEIN, P. P. N80-12422
BUGAEV, V. N. N80-12937
BUKOVATZ, J. E. N80-12251
BURGERS, P. N80-12443
BURGOS, J. J. N80-12685
BURNS, F. C. N80-12833
BURWITZ, P. N80-12492
BUSBY, J. P. N80-12597
BUSSARD, R. N80-12989
BUTLER, T. D. N80-12418
BYRNE, R. N. N80-12887

C

CABRAL, F. N80-12832
CALAHAN, D. A. N80-12769
CALLAWAY, J. N80-12846
CALLINAN, R. J. N80-12436
CALTAGIRONE, J. P. N80-12190
CAMPBELL-ALLEN, D. N80-12237
CARBONELL, J. G. N80-12764
CARDEN, J. L. N80-12735
CARLING, A. N80-12604
CARLSON, G. A. N80-12886
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CARLTON, R. W. N80-12541
CARNALL, W. T. N80-12938
CAROSELLA, L. A. N80-12695
CARVALHO, L. A. V. N80-12784
CASKEY, B. C. N80-12590
CASPER, T. A. N80-12879
CASTELLINO, P. N80-12230
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CASTILLO, R. A. N80-12616
CATANIA, F. N80-12588
CATOE, C. E. N80-12622
CAUSEY, W. H., JR. N80-12422
CAVALIERI, D. N80-12534
CAVANO, P. J. N80-12118

CERNOCKY, E. P. N80-12425
CERVISI, R. T. N80-12070
CHAMIS, C. C. N80-12120
CHAN, J. N80-12194
CHAN, K. K. N80-12430
CHAN, L. C. N80-12272
CHANDRA, U. N80-12428
CHANG, A. T. C. N80-12536
CHANG, F. H. N80-12423
CHANG, J. H. N80-12917
CHARLES, P. A. N80-12987
CHATTOT, J. J. N80-12014
CHEKUNOV, A. V. N80-12650
CHEN, C. T. N80-12157
CHEN, T. L. N80-12597
CHESNEY, J. R. N80-12970
CHIA-CHENG, C. N80-12644
CHIARIGLIONE, L. N80-12235
CHINCHILLI, V. M. N80-12799
CHINN, S. R. N80-12408
CHIRICO, R. D. N80-12116
CHIROVSKY, L. M. F. N80-12849
CHITTINENI, C. B. N80-12805
CHO, Y. C. N80-12824
CHOPRA, A. K. N80-12450
CHOUDHURY, B. J. N80-12536
CHUPP, W. N80-12149
CHYU, C. K. N80-12887
CLAASSEN, J. P. N80-12530
CLARK, B. V. N80-12530
CLARK, D. N80-12149
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CLARK, R. P. N80-12559
CLARK, T. N80-12089
CLEMMONS, R. E. N80-12057
CLERICI, E. N80-12458
CLINE, T. L. N80-12983
CLINE, G. L. N80-12181
CLOUTMAN, L. D. N80-12418
CO, A. N80-12309
COCHRAN, S. G. N80-12196
COCKS, F. H. N80-12609
COHEN, J. N80-12855
COHN, S. N80-12580
COLLIN, G. N80-12024
COLLIN, R. E. N80-12259
COLLINS, E. R. N80-12642
COLPIN, J. N80-12330
CONLEE, J. L. N80-12895
COOK, N. G. W. N80-12648
COOKE, C. H. N80-12372
CORRICK, G. E. N80-12733
COTTINGHAM, J. G. N80-12610
COUCHMAN, J. C. N80-12423
COULOMBEIX, C. N80-12014
COWPERTHWAITE, N. N80-12195
COX, F. W. N80-12203
COX, K. E. N80-12196
N80-12197
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COX, L. D. N80-12749
CRANNELL, C. J. N80-12988
CRAWFORD, K. N80-12204
CREER, H. E. N80-12094
CROSSWHITE, H. N80-12938
CROSSWHITE, H. M. N80-12938
CROW, E. L. N80-12277
CRUZ, G. N80-12267
CSAKVARY, T. N80-12961
CULIE, J. P. N80-12026
CULLER, V. H. N80-12730
CUSHING, D. H. N80-12688
CUTLER, E. P. N80-12988
CZAJKOWSKI, A. F. N80-12949

D

DAGE, E. N80-12173
DALLOLIO, C. N80-12217
DAMASSO, E. D. N80-12229
DANCER, R. F. N80-12081
DANG, K. N80-12027
DAREE, K. N80-12213
DARGAY, J. N80-12604
DAUGE, B. C. N80-12690
DAUTER, M. I. N80-12249
DASILVATOME, C. N80-12014
DAT, R. N80-12005
DAVIS, B. N80-12091
DAVIS, C. G. N80-12971
DAVIS, D. L. N80-12873
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DAWSON, J. W. N80-12295
DAY, J. N80-12130
DEAN, S. O. N80-12583
DECAMPOLI, G. N80-12429
DECARVALHO, V. C. N80-12519
DEERING, D. W. N80-12524
DEFLAMMINEIS, A. N80-12220
DEFOREST, S. E. N80-12883
DEGNAN, J. J. N80-12405
DEJACE, J. N80-12522
DEJESUSPARADA, N. N80-12519
DEJONG, G. F., II N80-12763
DELERY, J. N80-12031
DENNERT-MOELLER, E. N80-12481
DENNIS, B. R. N80-12988
DENTON, J. D. N80-12369
DEPADOVA, S. N80-12222
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DEPPNER, F. O. N80-12950
DESAI, U. D. N80-12983
DEVARAKONDA, V. K. N80-12179
DEVOTO, R. S. N80-12886
DIETZE, H. N80-12493
DILLON, J. L. N80-12064
DIMOTAKIS, P. E. N80-12379
DINARDO, L. R. N80-12244
DINKELOO, C. N80-12111
DIPINO, D. N80-12219
DIVENS, W. G. N80-12403
DODD, H. M. N80-12590
DOEFEL, H. J. N80-12499
DOERFFER, R. N80-12478
DOERJES, J. N80-12481
DOKKO, W. N80-12158
DOLAN, J. G. N80-12988
DONNELLY, R. F. N80-12112
DORDAIN, J. J. N80-12032
DORN, D. N80-12955
DORRER, E. N80-12459
DOWNS, W. N80-12192
DOYLE, E. J. N80-12613
DRAKE, M. S. N80-12413
DRIVER, M. C. N80-12285
DROESSLER, E. N80-12662
DUDEK, J. N80-12967
DUEWER, W. H. N80-12651
DUKOWICZ, J. K. N80-12418
DUNAYEVSKY, V. N80-12443
DUNN, K. P. N80-12870
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DUNTLEY, S. Q. N80-12645
DURELLI, A. J. N80-12441
DURHAM, D. L. N80-12751
DUTTON, R. W. N80-12292
DWIGHT, K. N80-12935
DYCKMAN, E. N80-12173
DYER, T. M. N80-12400

E

EARP, R. L. N80-12283
EAST, J. R. N80-12284
EBNER, H. N80-12460
EDELMAN, R. L. N80-12261
EDEN, J. G. N80-12410
EHLERS, M. N80-12480
EHRHARDT, A. R. N80-12877
EISSENBERG, D. M. N80-12568
ELDRIDGE, G. W. N80-12285
ELGIN, J. H., JR. N80-12532
ELIAS, G. N80-12025
ELKIND, M. M. N80-12631
ELLENBECK, H. N80-12461
EMANUEL, W. R. N80-12632
EMUNDS, H. N80-12036
ENDLICHER, W. N80-12489
ENGRAND, D. N80-12028
ENSMINGER, D. A. N80-12956
ERDELSKY, P. J. N80-12274
ERHARDT, K. N80-12050
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ERLINGER, M. A. N80-12762
ERMAK, D. L. N80-12627
ESCH, H. N80-12037
ESTABROOK, K. N80-12874
ESTREICH, D. B. N80-12292
ETSION, I. N80-12414
EVANS, A. K. N80-12728
EVANS, D. N80-12982
EVANS, W. D. N80-12983

F

FABRIS, G. N80-12882
FAETH, G. M. N80-12142
FAIRLIE, B. D. N80-12062
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FALCON, J. N80-12112
FALK, J. E. N80-12767
FALLSTAEDT, D. N80-12165
FAULMANN, D. N80-12019
FAUQUIGNON, C. N80-12206
FAVIN, S. N80-12375
FEDOROV, E. K. N80-12667
FELBECK, D. K. N80-12119
FELDMAN, F. R. N80-12972
FELDSTEIN, C. N80-12730
FERGUSON, G. N80-12387
FERNANDEZ, S. N80-12509
FIEBIG, M. N80-12043
FINCKE, J. R. N80-12420
FINK, J. H. N80-12886
FINSTON, M. N80-12105
FIORETTI, R. W. N80-12749
FISCHER, A. K. N80-12842
FISCHER, W. N80-12512
FISCKO, K. A. N80-12053
FISH, N. J. N80-12296
FLECK, V. N80-12207
FLEMING, J. W. N80-12829
FLOHN, H. N80-12676
FLYNN, G. M. N80-12302
FLYNN, L. N80-12421
FOERSCHING, H. N80-12001
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N80-12004
FOLEY, R. T. N80-12554
FOLKARD, M. N80-12931
FONG, K. W. N80-12584
FONTIJN, A. N80-12411
FORREST, S. R. N80-12156
FORSMAN, W. C. N80-12121
FORZANI, B. N80-12451
FOX, J. H. N80-12377
FRANKE, C. N80-12483
FRASCA, J. W. N80-12454
FRASER, R. J. N80-12057
FRAUENFELDER, H. N80-12835
FRAWLEY, W. H. N80-12806
FRAZIER, T. W. N80-12951
FREY, G. N. N80-12768
FRIMOUT, D. N80-12034
FROMM, H. J. N80-12185
FROST, K. J. N80-12988
FRYE, L. D. N80-12172
FUKUI, H. N80-12682
FULLER, C. C. N80-12907
FULLER, G. M. N80-12995

G

GABEL, L. R. N80-12259
GALLOWAY, G. E. N80-12634
GALLUS, H. E. N80-12336
GARVEY, D. M. N80-12664
GASKELL, T. F. N80-12689
GATES, L. W. N80-12671
GEHRKE, A. N80-12490
GEISSLER, W. N80-12008
GERADIN, M. N80-12010
GERASIMOV, I. P. N80-12670
GERHARD, M. A. N80-12449
GERRY, C. C. N80-12254
GERSHKOFF, I. N80-12255
GETTINGER, F. F. N80-12301
GHASSEMI, M. N80-12204
GIBBONS, D. E. N80-12399
GIENAPP, H. N80-12516
GIGNAC, D. A. N80-12792
GILBERT, W. S. N80-12836
GILLEN, K. T. N80-12424
GILLILAND, W. J. N80-12251
GILLINGHAM, B. E. N80-12266
GINER, J. N80-12609
GINOUX, J. J. N80-12352
GIRARD, A. N80-12020
N80-12034
GIRAUD, M. N80-12209
GIUFFRE, M. S. N80-12856
GLASS, I. I. N80-12373
GLOERSEN, P. N80-12534
GOBLE, J. C. N80-12393
GODBOLE, R. M. N80-12848
GOLAN, S. N80-12252
GOLD, H. S. N80-12139
GOLDBERG, E. D. N80-12718
GOLDEN, T. S. N80-12957
GOLDSTEIN, R. N80-12383
GONCZY, J. D. N80-12295
GOODWIN, G. M. N80-12417
GORDON, J. I. N80-12645
GORDON, R. N80-12967
GOTS, W. C. N80-12383
GOSSMANN, H. N80-12487
GOTO, T. N80-12629
GOULDING, F. S. N80-12294
GOUPIL, D. W. N80-12908
GOVIND, S. N80-12268
GRAF, O. F., JR. N80-12103
GRAHAM, M. L. N80-12058
GRALNICK, S. L. N80-12904
GRAY, H. L. N80-12789
GREEN, J. A. S. N80-12161
GREEN, L. G. N80-12422
GREEN, P. A. N80-12734
GREENBERG, B. L. N80-12918
GREENSTEIN, M. N80-12548
GREER, H. C., III N80-12751
GREGORY, G. L. N80-12664

GREITZER, F. M. N80-12326
N80-12327
N80-12328
GRETHER, D. N80-12647
GRETHER, D. F. N80-12589
N80-12982
GRIMES, V. S., JR. N80-12075
GRIMM-STRELE, J. N80-12491
GROETZBACH, G. N80-12320
GROSE, D. L. N80-12083
GRUEMMER, E. N80-12049
GRUEN, A. N80-12462
GRUNDMANN, R. N80-12045
GUENTHER, P. N80-12841
GUGLIELMO, M. N80-12235
GUPTA, P. K. N80-12817
GUPTA, R. P. N80-12941
GURNEY, R. J. N80-12526
GURUSWAMY, P. N80-12073
GUSTAFSON, D. A. N80-12758
GUY, C. R. N80-12099

H

HAACK, J. K. N80-12811
HAALAND, D. M. N80-12150
HABERAECKER, P. N80-12480
HABRA, N. R. N80-12761
HACKING, K. N80-12382
HADDAD, G. I. N80-12284
HAEFELE, W. N80-12677
HAGHGOOIE, M. N80-12913
HAHN, H. T. N80-12124
HAHN, M. N80-12055
HAIDL, G. N80-12012
HAIN, G. N80-12378
HAISLER, W. E. N80-12447
HALDEMAN, C. W. N80-12105
HALL, C. A. N80-12791
HALL, R. B. N80-12637
HALLER, E. E. N80-12294
HALLISSY, J. B. N80-12084
HAM, R. N80-12963
HAMALAINEN, J. R. N80-12748
HAMMOND, J. P. N80-12170
HAMONOU, M. N80-12357
HAMPTON, H. L. N80-12573
HANEY, S. J. N80-12946
HANLEY, G. N80-12106
HANSEN, W. L. N80-12294
HARDY, D. M. N80-12710
HARE, K. F. N80-12669
HARLAMBAKIS, C. N80-12094
HARLAN, J. C. N80-12524
HARRANG, J. N80-12295
HARRAR, J. E. N80-12561
HARRIS, J. C. N80-12152
HART, W. D. N80-12535
HARTE, J. N80-12874
HARTMAN, J. S. N80-12573
HARVAL, R. N80-12387
HARWELL, K. E. N80-12113
HASELMAN, L. C. N80-12625
HAWRYLUK, R. J. N80-12888
HAYDN, R. N80-12509
HEBBARD, P. N80-12024
HECKES, A. A. N80-12572
HEDSTROM, J. C. N80-12577
HEILMAN, J. L. N80-12518
HELBIG, H. N80-12496
HENDRICKS, C. D. N80-12834
HENNIGAN, K. B. N80-12257
HENRICK, R. F. N80-12826
HENRY, R. J. W. N80-12846
HEPLER, L. J. N80-12088
HEPPNER, J. P. N80-12986
HERMANN, R. N80-12776
HETZEL, R. N80-12112
HEWITT, R. P., JR. N80-12123
HEYSER, R. C. N80-12256
HEYWOOD, J. B. N80-12090
HICKERSON, J. L. N80-12639
HICKMAN, A. P. N80-12646
HIELSCHER, U. N80-12146
HILAL, M. A. N80-12295
HILDEBRANDT, G. N80-12471
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HILDERBRANDT, G. N80-12498
HILL, C. D. N80-12715
HILL, G. R. N80-12619
HILTON, D. A. N80-12820
HINDMAN, E. E., II N80-12663
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HINKEBEIN, T. E. N80-12572
HINMAN, G. W. N80-12558
HIRAYAMA, M. Y. N80-12057
HIRSCH, C. N80-12367
HIRSCHEL, E. H. N80-12046
HIRSHMAN, S. P. N80-12815
HIRT, C. W. N80-12381
HIRT, F. H. N80-12485
HISCOCK, W. A. N80-12977
HITT, E. N80-12089
HO, C. N80-12961
HOBBIE, D. N80-12463
HOBBINS, R. N80-12164
HOCKER, L. P. N80-12091
HODGDON, R. B. N80-12551
HODGE, P. G., JR. N80-12445
HOFENER, S. D. N80-12185
HOFFMAN, C. N80-12835
HOFFMAN, H. W. N80-12568
HOFFMAN, M. N80-12260
HOFFMAN, M. A. N80-12852
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HOKE, S. H. N80-12114
HOLBEN, B. N. N80-12532
N80-12533
N80-12716
HOLCOMB, J. N80-12628
HOLDREN, J. P. N80-12364
HOLLANDERS, H. N80-12595
HOLLECK, G. L. N80-12380
HOLLOWELL, C. D. N80-12510
HOPPE, P. N80-12289
HOPWOOD, J. N80-12935
HORMADALY, J. N80-12980
HORVATH, P. N80-12071
HOSNY, W. M. N80-12180
HOSSAIN, M. B. N80-12570
HOUSE, P. A. N80-12441
HOVANESIAN, J. D. N80-12406
HOWARTH, R. F. N80-12720
HOWE, J. T. N80-12082
HOWELL, G. C. N80-12951
HOWELL, W. Y. N80-12074
HSIEH, T. N80-12951
HUANG, S. Y. N80-12295
HUANG, Y. C. N80-12478
HUBER, K. N80-12278
HUFFORD, G. A. N80-12214
HUGENSCHMIDT, M. N80-12237
HUGHES, G. W. N80-12441
HUNG, Y. Y. N80-12647
HUNT, A. N80-12982
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HUNTER, S. J. N80-12851
HUNTRESS, W. T. N80-12983
HURLEY, K. N80-12263
HURST, D. P. N80-12812
HUTCHISON, D. W. N80-12522
HUYGEN, J. N80-12406
HYDE, M. E.

I

IBEMESI, J. A. N80-12175
INFANTE, E. F. N80-12784
INGRAM, C. W. N80-12111
ISLER, W. N80-12173
IZRAEL, J. A. N80-12673

J

JACKSON, L. B. N80-12117
JACOBSON, A. R. N80-12885
JACOBSON, M. J. N80-12826
JAENDEL, D. N80-12321
JAKUS, K. N80-12872
JAMET, F. N80-12212
JAMISON, D. B. N80-12648
JANIAK, H. N80-12636
JAWTUSCH, V. N80-12046
JAYADEV, T. S. N80-12564
JAYAPRAKASH, G. P. N80-12251
JEA, L. C. N80-12119
JEAN, B. R. N80-12530
JENKINS, C. R. N80-12422
JHABVALA, M. D. N80-12281
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JIUSTO, J. N80-12662
JOHNSON, C. E. N80-12882
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JOHNSON, E. F. N80-12904
JOHNSON, R. T. J. N80-12939
JOHNSON, R. W. N80-12645
JOHNSON, W. L. N80-12162
N80-12171
JOLY, C. N80-12349
N80-12350
JONES, R. N80-12436
JONES, R. E. N80-12584
N80-12772
JONES, T. C. N80-12641
JONES, W. M. N80-12605
JONES, W. P. N80-12323
JONES, W. W. N80-12145
JORDAN, P. R. N80-12655
JUILLERAT, R. N80-12033
JUMIKIS, A. R. N80-12244
JUSTICE, C. N80-12533

K

KABE, A. M. N80-12431
KACZMAREK, Z. N80-12678
KADRO, A. N80-12513
KALETTA, G. R. N80-12895
KAN, C. L. N80-12450
KANDA, M. N80-12276
KANG, D. N80-12188
KANT, T. N80-12437
KAPPEL, F. N80-12705
KARATSENIDES, S. P. N80-12098
KARNEY, C. F. F. N80-12296
KATES, R. W. N80-12691
KATZ, J. L. N80-12260
N80-12261
KAW, P. K. N80-12884
KEARNEY, D. W. N80-12896
KEELE, R. V. N80-12274
KELLER, C. F. N80-12971
KELLERSMANN, H. N80-12491
KELLEY, J. L. N80-12898
KELLOGG, R. B. N80-12793
KELLY, J. R. N80-12195
KENT, J. S. N80-12077
KERN, E. C., JR. N80-12566
KERSHAW, R. N80-12935
KEULER, P. N80-12486
KEYS, R. D. N80-12123
KIM, H. H. N80-12535
KIM, J. M. N80-12308
KIM, S. B. N80-12295
KINDLE, E. C. N80-12623
KING, J. F. N80-12417
KIRCHHOFF, J. N80-12948
KISHI, J. S. N80-12088
KLEBESADEL, R. W. N80-12983
KLEIN, H. N80-12464
KLEISER, L. N80-12320
KMETYK, L. N. N80-12905
KNISELEY, R. N. N80-12611
KOBAYASHI, A. S. N80-12447
KOCAY, C. A. N80-12597
KOCH, B. N80-12210
KOCIN, P. J. N80-12527
KOEHN, B. W. N80-12158
KOENIG, M. N80-12314
KOHL, M. N80-12522
KOLLMANN, W. N80-12366
KOLOUCH, D. N80-12476
KONECNY, G. N80-12458
N80-12469
KONISH, H. J. N80-12447
KOO, F. H. N80-12123
KOONTZ, J. P. N80-12138
KOPLIK, C. M. N80-12856
KOTA, S. L. N80-12280
KRAHN, W. N80-12041
KRAUSE, E. N80-12362
KRAUSE, H. N80-12473
KRAUTH, E. N80-12473
KREISS, H. O. N80-12359
KRESKOVSKY, J. P. N80-12096
KRIEGER, R. B. N80-12418
KRIER, H. N80-12146
KRISHNAMURTI, R. N80-12658
N80-12659
KRISHNAMURTI, T. N. N80-12658
KRITIKOS, G. N80-12503
KROEGER, R. N80-12967
KUBASCO, A. J. N80-12192
KUBO, R. N80-12629
KUDVA, N. J. N80-12434
KUHN, R. E. N80-12085
KUPFER, G. N80-12461
KURTH, W. S. N80-12640
KURYLOWICH, G. N80-12072
KWOK, K. C. S. N80-12239

L

LACOURISERE, S. A. N80-12349
LAKAS, G. R. N80-12631
LALA, G. G. N80-12662
LAMBERTSON, G. R. N80-12836
LAN, C. E. N80-12061
LANCE, G. S. N80-12968
LANE, C. R. N80-12868
N80-12869
LANGE, G. N80-12508
LANGE, R. N80-12627
LANGER, G. N80-12664
LANHAM, C. N80-12087
LANTZ, J. B. N80-12959
LARK, R. F. N80-12120
LAROS, J. G. N80-12983
LARSON, D. C. N80-12593
LAW, D. A. N80-12185
LECOMPTE, J. L. N80-12714
LEE, H. N80-12586
LEE, H. M. N80-12273
LEE, Y. C. N80-12902
LEFFERTS, J. L. N80-12180
LEGENDRE, R. N80-12022
LEHR, H. F. N80-12208
LELARGE, A. N80-12025
LEO, H. R. N80-12126
LEONARDS, G. A. N80-12250
LERIGOLEUR, C. N80-12349
LESKIN, D. M. N80-12271

LESLIE, F. W. N80-12657
LEUCHTER, O. N80-12027
LEWIS, G. W. N80-12730
LEWIS, M. N80-12387
LICHTENBERGER, A. N80-12206
LIEBERG, M. N80-12295
LIEPMANN, H. W. N80-12379
LIFSHITZ, N. N80-12911
LIND, M. A. N80-12573
LINDIG, C. N80-12005
LIONS, J. L. N80-12360
LIPSHITZ, A. N80-12414
LITTLEFORD, A. N80-12813
LOFFREDA, A. N80-12220
LOGAN, B. G. N80-12886
LOHMANN, P. N80-12475
LOMBARD, J. M. N80-12206
LOMBARDO, M. A. N80-12519
LONGUSKI, J. M. N80-12978
LOOS, A. C. N80-12122
LOPEZ-FERNANDEZ, S. H. N80-12303
LOURME, D. N80-12032
LOVELL, C. W. N80-12244
LOWRY, R. E. N80-12177
LUCAS, B. J. N80-12798
LUCAS, R. J. N80-12875
LUDWIG, G. R. N80-13069
LUKASZEK, T. N80-12825
LUKENS, L. I. N80-12563
LUMLEY, J. L. N80-12310
LUMMUS, J. R. N80-12093
LYDEN, J. K. N80-12131
LYONS, J. M. N80-12110
LYONS, P. B. N80-12891
LYONS, S. W. N80-12708
LYSMER, J. N80-12243

M

MACH, H. N80-12311
MACHTA, L. N80-12674
MACKENZIE, E. J. N80-12797
MADDALONE, R. F. N80-12153
MADRID, J. N80-12891
MADSEN, O. S. N80-12726
MAESTRELLO, L. N80-12821
MAGRE, P. N80-13024
MAHAL, A. N80-12054
N80-12055
MAHR, B. N80-12493
MAINGUY, A. M. N80-12033
MAJAHAD, P. S. N80-12609
MAJTELES, M. N80-12586
MANE, R. M. N80-12555
MANKOVICH, T. E. N80-12760
MANNING, R. G. N80-12401
MANTZ, H. C. N80-12895
MANUCCI, F. N80-12221
MAR, R. W. N80-12574
MARACCI, G. N80-12522
MARBLE, F. E. N80-12379
MARCHUK, G. I. N80-12672
MARGETAN, F. J. N80-12847
MARKO, A. N80-12731
MARLAND, G. N80-12544
MARONI, V. A. N80-12897
MARSH, A. B. N80-12757
MARSHALL, R. L. N80-12816
MARTIN, G. M. N80-12183
MARTIN, J. G. N80-12602
MARTIN, M. N80-12589
MARTINSON, J. N80-12015
MARTZ, J. E. N80-12552
MASON, B. N80-12578
MASON, B. J. N80-12675
MASON, M. L. N80-12086
MASON, R. M. N80-12735
MASUMY, S. A. N80-12498
MATHEWS, D. N80-12422
MATHIEU, J. N80-12321
MATSON, M. N80-12520
MATSUZAKI, Y. N80-12435
MATTEI, F. N80-12683
MATTHIAS, A. D. N80-12617
MAULARD, J. N80-12025
MAURER, F. N80-12035
MAYNARD, N. C. N80-12986
MAYO, A. A. N80-12781
MCAULAY, J. E. N80-12092
MCCANDLESS, S. W., JR. N80-12719
MCCLAIN, C. R. N80-12535
MCCLEER, P. J. N80-12284
MCCLELLAND, J. F. N80-12611
MCCLENNY, W. A. N80-12633
MCCORMACK, J. N80-12750
MCCRACKIN, F. L. N80-12183
MCDEVITT, N. T. N80-12160
MCDONALD, H. N80-12096
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MCFADDEN, G. B. N80-12051
MCGINNIS, D. F. N80-12520
MCGLAUN, J. M. N80-12814
MCGRADY, W. J. N80-12282
MCGREGOR, K. T. N80-12637
MCKIBBEN, J. N80-12835
MCLEAN, J. T. N80-12622
MCMURTREY, J. E., III N80-12532
MCNELLIS, J. M. N80-12655
MCNIVEN, H. D. N80-12241
MCNUTT, S. L. N80-12546
MCQUIGG, J. D. N80-12681
MCWHORTER, A. L. N80-12934
MEAUZE, G. N80-13016
MEIGER, J. N80-12873
MEMBOTNA, S. C. N80-12061
MEIER, A. N80-12380
MEISS, J. D. N80-12721
MELBOURNE, W. H. N80-12239
MELDNER, H. N80-12859
MELNIKOW, M. N80-12755
MENGI, Y. N80-12241
MEYERHOFF, A. N80-12961
MICHEL, R. N80-13019
MILEWITS, M. N80-12912
MILLER, G. N80-12890
MILLER, R. D. N80-12056
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MILLER, S. H. N80-12521
MILLER, T. M. N80-12646
MILLS, C. F. N80-12774
MILLS, R. G. N80-12904
MIRA, N. K. N80-12043
MISCHKE, R. N80-12835
MISCHKE, T. M. N80-12618
MITCHELL, J. E. N80-12244
MITRA-ROY, H. K. N80-12426
MODENA, G. N80-12230
MOE, T. E. N80-12986
MOGAVERO, L. N80-12397
MOHNEN, V. N80-12662
MOLLOY, E. C. N80-12180
MOLVIG, K. N80-12815
MOND, M. N80-12876
MONISMITH, C. L. N80-12244
MOON, R. M. N80-12837
MOORE, D. G. N80-12518
MOORE, R. C. N80-12952
MOORE, S. W. N80-12577
MORAGUES, J. A. N80-12612
MORENO, L. N80-12218
MORRIS, G. N80-12628
MORRISON, G. L. N80-12251
MOULARD, H. N80-12306
MOULTHROUP, P. N80-12955
MROCZYNSKI, R. P. N80-12528
MUELLER, A. C. N80-12103
MULCAY, W. N80-12060
MUNGUR, P. N80-12818
MUNN, R. E. N80-12674
MUNUKUTLA, L. V. N80-12925
MURPHY, C. H. N80-12067
MURRAY, G. G. N80-12274

N

NAAMAN, A. E. N80-12453
NABOZNY, R. L. N80-12342
NAGLE, D. E. N80-12835
NAGLER, R. G. N80-12719
NAKAHARA, N. N80-12629
NAKAJIMA, Y. N80-12629
NARATH, A. N80-12165
NATHANSON, H. C. N80-12285
NAYMIK, T. G. N80-12545
NEBBIA, L. N80-12230
NEEF, W. S., JR. N80-12886
NEEMAN, Y. N80-12842
NEHRING, U. N80-12047
NELSON, J. P. N80-12635
NENE, V. D. N80-12962
NENNI, J. P. N80-12069
NEOGI, P. N80-12307
NEUBERGER, W. A. N80-12044
NEUDECK, G. W. N80-12422
NEUMANN, L. N80-12796
NEWMAN, J. C. N80-12447
NEWTON, R. W. N80-12530
N80-12537
NI, W. M. N80-12304
NIEDERLOEHNER, U. N80-12042
NIEL, M. N80-12983
NIEMANN, R. C. N80-12288
NIEMEIER, W. H. N80-12077
NIEMZ, E. N80-12517
NIHOUL, J. C. J. N80-12322
NITHACK, J. N80-13094
NORMENT, H. G. N80-12700
NORTHRUP, C. J. N80-12572
NOWAK, P. N80-12504
NUEBLER, W. N80-12488
NYHOLM, R. A. N80-12627

O

OCHOA, A., JR. N80-12292
ODENCRANTZ, F. K. N80-12464
ODENGO, R. S. N80-12686
OERTEL, H. N80-12211
OETTINGER, F. F. N80-12300
OEY, K. N80-12236
OFFIELD, T. W. N80-12521
OFOGHLUDDIA, F. N80-12940
OGBURN, F. N80-12173
OGUNTOYINBO, J. S. N80-12686
OKHUSI, T. H. N80-12329
OMAR, E. N80-12554
N80-12055
ONO, K. N80-12448
ORNER, N. N80-12337
OROURKE, M. J. N80-12240
ORWIG, L. E. N80-12988
OSTENDORF, D. W. N80-12724
OSTERKAMP, W. R. N80-12655
OSTON, S. G. N80-12856
OTT, R. H. N80-12278
OWEN, J. R. N80-12976
OWEN, L. B. N80-12561
OXBERGER, R. D. N80-12968
OZA, R. D. N80-12186

P

PACKER, L. L. N80-12416
PADDOCK, W. L. N80-12653
PADMANABHAN, V. N80-12433
PAGANA, E. N80-12223
N80-12224
N80-12225
N80-12226
N80-12227
PAPADALES, B. S., JR. N80-12086
PAPANIKAS, D. G. N80-12042
N80-12092
PARR, C. H. N80-12467
PARR, W. C. N80-12790
PARTER, S. V. N80-12794
PARUNGO, F. P. N80-12663
N80-12664
PATE, W. H. N80-12928
PATTERSON, G. N. N80-12189
PATZ, H. S. N80-12929
PAULHUS, N. G., JR. N80-12964
PAYNE, H. J. N80-12773
PEACOCK, R. E. N80-12332
N80-12333
PELCHAT, M. G. N80-12266
PEMBLETON, R. G. N80-12838
PENDERGRASS, J. H. N80-12605
PENG, S. T. N80-12262
PENLAND, J. A. N80-12064
PENNINGTON, J. E. N80-12732
PERKINS, D. R. N80-12775
PERRY, C. W. N80-12624
PERULLI, M. N80-13025
PERZAK, F. J. P. N80-12864
PESKIN, A. M. N80-12753
PESSES, M. E. N80-12975
PETERSON, D. T. N80-12168
PETERSON, J. R. N80-12557
N80-12646
PETERSON, K. R. N80-12712
PETRICK, M. N80-12882
PETTUJOHN, R. R. N80-12401
PFEIFER, H. J. N80-12313
PFEIFFER, H. N80-12040
PHILIPPE, J. J. N80-12030
PHILLIPS, D. H. N80-12422
PIACSEK, S. A. N80-12378
PIAZZOLI, G. N80-12006
PICCIONE, D. N80-12867
PICHOIR, R. N80-12017
PIERSON, E. S. N80-12882
PIKUL, R. R. N80-12240
PITKARANTA, J. N80-12793
PITTMAN, J. L. N80-12065
PIZZICHINI, G. N80-12983
POLICELLA, H. N80-12018
POLLAK, G. D. N80-12856
POLLOCK, N. N80-12062
N80-12063
POMPHREY, N. N80-12721
POPOV, E. P. N80-12451
POPPELBAUM, W. J. N80-12807
PORCH, W. M. N80-12712
PORSCHING, T. A. N80-12791
POST, R. F. N80-12900
POTOR, G. N80-12731
POTTER, J. M. N80-12835
PRAVDO, S. H. N80-12967
PREINING, O. N80-12402
PRETL, R. N80-12219
PRICE, W. G., JR. N80-12904
PRINCE, F. P. N80-12727
PUGH, C. N80-12297
PUNWANI, D. V. N80-12199
PUTNAM, L. E. N80-12046

Q

QUHL, F. N80-12502

QUIGLEY, R. M. N80-12244
QUINLIVAN, S. N80-12204

R

RAAD, L. N80-12244
RABER, E. N80-12561
RABURN, W. D. N80-12422
RADHAKRISHNAN, K. N80-12090
RAMBACK, G. N80-12571
RAMSHAW, J. D. N80-12418
RAND, J. L. N80-12068
RASMUSSEN, G. T. N80-12137
RATAJCZAK, A. F. N80-12552
RATCLIFF, B. D. N80-12553
RATEAU, P. N80-12316
RATINO, D. N80-12731
RAUFMAN, E. H., JR. N80-12786
RAY, N. J. N80-12756
RECHEN, J. B. N80-12836
REE, F. H. N80-12839
REED, J. W. N80-12709
REGEHLY, H. N80-12477
REICHERT, P. G. N80-12500
N80-12515
REIDINGER, F. N80-12924
REINIGER, P. N80-12522
N80-12525
N80-12526
N80-12531
REISKIN, A. B. N80-12394
REISS, P. N80-12460
REMAK, R. N80-12969
RENIER, J. P. N80-12602
RHEA, J. O. N80-12716
RHODES, D. B. N80-12866
RHODES, I. B. N80-12777
RICH, E. A. N80-12743
RICHARD, R. B. N80-12399
RICHARDS, F. M., JR. N80-12440
RICHARDSON, L. M. N80-12922
RICHARDSON, W. N80-12529
RICHTER, R. N80-12149
RICHTSCHEID, P. N80-12495
RIEDEL, H. N80-12036
RIETHMULLER, M. N80-12352
RILEY, J. L. N80-12382
RINAMAN, W. C. N80-12795
RITGER, A. J. N80-12923
RITTER, J. E., JR. N80-12872
RIVORD, G. E. N80-12150
ROBB, L. J. N80-12803
ROBEL, M. C. N80-12861
ROBERT, K. N80-12045
N80-12048
ROBERTSON, J. N80-12558
ROBERTSON, R. C. N80-12575
ROBIN, A. M. N80-12191
ROBINSON, D. H. N80-12802
ROBINSON, R. S. N80-12713
RODD, J. N80-12415
RODI, W. N80-12319
ROGERS, F. J. N80-12903
ROGERS, J. C. W. N80-12375
ROGERS, W. L. N80-12961
ROMAINE, W. R. N80-12592
ROMANIUK, M. S. N80-12306
ROPER, H. N80-12238
ROSZ, T. A. N80-12265
ROSEMA, A. N80-12526
ROSEME, G. D. N80-12380
ROSENBERG, A. M. N80-12185
ROSENBERG, J. T. N80-12195
ROSENBERG, R. A. N80-12845
ROSENBLOOM, S. N80-12969
ROSENFELD, A. N80-12380
ROSENGA, G. N80-12224
N80-12225
N80-12226
N80-12227
BOSHKO, A. N80-12379
ROSS, B. L. N80-12856
ROSS, D. H. N80-12110
ROSS, M. N80-12839
ROSS, R. W. N80-12970
ROTH, J. T. N80-12951
ROUSE, J. W. N80-12537
ROYER, H. N80-12209
RUBIN, S. N80-12301
RUBINCAM, D. P. N80-12643
RUDDY, J. M. N80-12260
RUJBANI, S. M. N80-12801
RUSSELL, L. H. N80-12187
RUSSELL, M. C. N80-12566
RUSSO, A. J. N80-12894
RUTHERFORD, P. H. N80-12884
RYAN, L. E. N80-12153
RYBAK, S. C. N80-12538
RYER, M. J. N80-12766

S

SADOWSKI, E. P. N80-12163
SAFFMAN, P. G. N80-12379
SAGEAU, J. F. N80-12357
SAITO, T. N80-12373
SAMARA, G. A. N80-12943
SANDERS, N. D. N80-12831
SANTAGOSTINO, M. N80-12218
SASSIN, W. N80-12677
SAUNDERS, S. E. N80-12744
SAUTY, J. P. N80-12344
N80-12345
SAVALLE, S. N80-12026
SAVERY, C. W. N80-12593
SAX, H. N80-12470
SCAGLIOLA, C. N80-12230
N80-12231
N80-12232
N80-12233
SCHAAKE, J. C., JR. N80-12678
SCHAEFER, H. J. N80-12312
SCHAEFER, V. N80-12662
SCHARF, L. L. N80-12783
SCHECTER, S. N80-12787
SCHEPERS, H. J. N80-12040
SCHEPPELE, S. E. N80-12193
N80-12198
N80-12102
SCHERER, M. N80-12456
SCHILILCHER, M. N80-12339
SCHLUENDER, E. U. N80-12479
SCHMIDT, D. N80-12368
SCHMIDT, E. N80-12032
SCHMITT, D. N80-12497
SCHNEIDER, K. H. N80-12407
SCHNEIDER, R. E. N80-12467
SCHROEDER, M. N80-12468
N80-12097
SCHROLL, D. W. N80-12808
SCHUCANY, W. R. N80-12506
SCHUHR, W. N80-12863
SCHULT, O. W. B. N80-12315
SCHULTZE, G. N80-12466
SCHULZ, B. S. N80-12320
SCHUMANN, U. N80-12649
SCHUSTER, C. L. N80-12588
SCHUTZ, S. B. N80-12050
SCHWEIGER, G. N80-12269
SCHWERING, F. N80-12270
N80-12271
N80-12215
SCHWERTL, M. N80-12933
SCHWUTTKE, G. H. N80-12235
SCIARAPPA N80-12077
SCOTT, J. N80-12967
N80-12600
SCOTT, R. J. N80-12981
SCUDDER, J. D. N80-12950
SCULLY, W. C. N80-12410
SEALES, S. K. N80-12649
SEAVEY, R. W. N80-12759
SEIDEL, S. R. N80-12509
SEIDERER, M. N80-12164
SEIFFERT, S. L. N80-12251
SEITZ, R. D. N80-12388
SELTZER, S. M. N80-12104
SENIW, W. P. N80-13011
SENSBURG, O. N80-12769
SESEK, E. J. N80-12968
SEUM, J. F. N80-12276
SHAFER, J. N80-12452
SHAH, S. P. N80-12453
N80-12684
N80-12355
SHAO-WU, W. N80-12731
SHAPIRO, I. N80-12880
SHARPER, C. N80-12404
SHAW, D. T. N80-12712
SHEOREY, R. S. N80-12448
SHERMAN, C. N80-12111
SHIBATA, M. N80-12830
SHIDA, D. N80-12961
SHUBIK, M. N80-12412
SHUM, L. Y. N80-12576
SIDDIQUI, E. U. A. N80-12941
SIDLES, P. H. N80-12826
SIEGEL, R. W. N80-12901
SIEGMANN, W. L. N80-12850
SIGMAR, D. J. N80-12891
SILVER, M. D. N80-12945
SIMMONS, D. N80-12120
SIMPSON, G. A. N80-12349
SINCLAIR, J. H. N80-12244
SINGH, U. K. N80-12926
SISTI IANO, W. J. N80-12775
SISSON, K. J. N80-12981
SITES, R. L. N80-12747
SITTLER, E. C., JR. N80-12748
SKOOG, E. N. N80-12417
N80-12128
SLAUGHTER, G. M. N80-12626
SLAUGHTER, M. D. N80-12249
SLINN, W. G. N. N80-12143
SMILEY, S. A. N80-12398
SMITH, A. N80-12841
N80-12752
SMITH, A. J. N80-12987
SMITH, B. W. N80-12084
SMITH, E. G.
SMITH, F. R. N80-12293
SMITH, F. T. N80-12646
SMITH, J. A. N80-12078
SMITH, J. M. N80-12881
SMITH, J. R. N80-12148
SMITH, L. E. N80-12177
SMITH, P. R. N80-12615
SMITH, R. E. N80-12141
SMITH, R. P. N80-12288
SNOW, G. A. N80-12057
SOBEL, M. J. N80-12810
SOICHER, B. N80-12967
SOLECKI, J. S. N80-12447
SOLI, A. L. N80-12174
SOLLOGUB, V. B. N80-12650
SOLOMON, J. S. N80-12160
SOLOMON, M. N80-12105
SOMAYAJI, S. N80-12452
SORENSON, L. N80-12635
SOROKA, J. M. N80-12129
SPACKMAN, T. J. N80-12395
SPEARS, R. K. N80-12182
SPENCER, A. E. N80-12754
SPRINGER, G. S. N80-12122
SPURLOCK, J. M. N80-12739
SQUIRES, P. N80-12662
SRIDHARAN, R. N80-12104
STACEY, W. M., JR. N80-12901
STAETTER, R. N80-12514
STANFORTH, R. N80-12963
STAPLES, J. N80-12149
STAUFFER, R. M. N80-12804
STEGMANN, R. N80-12963
STEIDEL, R. F. N80-12569
STEINBORN, T. L. N80-12860
STEININGER, M. N80-12012
STELLBRINK, K. N80-12125
STENZEL, A. N80-12215
STETKAR, R. A. N80-12250
STEVENS, R. K. N80-12633
STEWART, K. B. N80-12809
STEWART, R. J. S. N80-12961
STIRN, R. J. N80-12549
STOCK, P. N80-12685
STOVER, F. S. N80-12136
STRAITT, R. M. N80-12947
STREHLOW, R. A. N80-12146
STRGANAC, T. W. N80-12661
STRIZ, A. G. N80-12073
STROUD, R. O. N80-12530
STRUEBING, K. N80-12479
STRUMOLO, G. S. N80-12305
STRUSS, R. G. N80-12576
STUBBS, S. M. N80-12084
SUBBARAO, S. N. N80-12935
SUDARSHAN, E. C. G. N80-12842
N80-12862
SULLIVAN, W. N. N80-12579
SULOUFF, R. L. N80-12299
SUN, T. S. N80-12161
SUNG, C. C. N80-12871
SURPRENANT, N. F. N80-12637
SUWANAYUEN, S. N80-12140
SWAMINATHAN, M. S. N80-12680
SWANSON, L. W. N80-12286
N80-12932
SWEDLOW, J. L. N80-12647
SWEENEY, H. E. N80-12406
SWIFT, G. N80-12818
SZANTO, P. G. N80-12828
SZPIRO, E. N80-12055
SZU-C-CHUNG, C. N80-12684

T

TABACZYNSKI, R. J. N80-12090
TAGGART, H. E. N80-12276
TAI, T. C. N80-12085
TALLON, R. W. N80-12287
TANENBAUM, G. N80-12628
TANNER, J. A. N80-12084
TASSONE, G. N80-12522
N80-12526
TAYLOR, G. D. N80-12786
TAYLOR, J. L. N80-12159
TAYLOR, R. F. N80-12052
TAYLOR, W. N80-12966
TEEGARDEN, R. J. N80-12983
TEMBOURY, J. N80-12614
TENNEY, F. H. N80-12904
THEUNISSEN, P. H. N80-12353
THIBEAU, R. J. N80-12133
THODE, L. E. N80-12889
THOERMER, K. N80-12910
THOMAS, A. L., JR. N80-12264
THOMAS, J. A. N80-12906
THOMAS, M. U. N80-12740
THOMPSON, N. N80-12089
THRUN, K. E. N80-12152
TIBBETTS, J. G. N80-12819
TIETZEL, F. A. N80-12958
TIJDEMAN, H. N80-12009
TITTERTON, P. J. N80-12406
TOBIAS, W. N80-12492
TODD, A. M. M. N80-12904

TONIETTA, A. N80-12221
TOOKE, W. R., JR. N80-12185
TOTH, S. N80-12259
TRIENDL, E. N80-12301
TRIESCH, K. N80-12038
TROMBKA, J. I. N80-12386
TRUEBLOOD, R. P. N80-12742
TSONG, Y. N80-12800
TUBBS, A. D. N80-12974
TUCKER, C. J. N80-12532
TUOHY, L. R. N80-12987
TURIEL, I. N80-12980
TURKEL, E. N80-12361
N80-12821
TURNER, K. A. N80-12751
TURNER, L. R. N80-12295
TWITTY, J. T. N80-12623
TYNER, C. E. N80-12543

U

UEDA, T. N80-12435
ULBRICHT, K. A. N80-12509
N80-12510
UNDERWOOD, G. L. N80-12078
URBANIAK, J. J. N80-12973
URI, N. D. N80-12542
UTSUMI, H. N80-12631

V

VALEO, E. J. N80-12884
VANDENBROEK, C. D. N80-12343
VANDERHELM, D. N80-12180
VANGOOL, W. N80-12594
N80-12595
VANHOVE, W. N80-12370
VANWAMBEKE, P. N80-12330
VANZYL, D. J. A. N80-12244
VARWIG, R. L. N80-12110
VAUGHAN, P. J. N80-12638
VEDRENNE, G. N80-12983
VELAZCO, G. N80-12453
VELECKIS, E. N80-12097
VERSTEGEN, M. N80-12750
VICKERS, D. N80-12626
VISALVANICH, K. N80-12053
VISWANADHAM, R. K. N80-12161
VIVIAND, H. N80-12364
VOGEL, F. L. N80-12121
VOGLER, L. E. N80-12278
VOLKER, P. A. N80-12712
VOLLRATH, K. N80-12214
VONHESLER, A. N80-12404
VRABEL, M. J. N80-12770

W

WAGANER, L. M. N80-12895
WAGONER, J. L. N80-12860
WAHIG, M. N80-12647
N80-12982
WAHLIG, M. N80-12586
WAITE, W. A. N80-12551
WALCH, J. J. N80-12033
WALDEN, T. N80-12391
WALKER, J. A. N80-12784
WALTERS, G. B. N80-12078
WANG, J. B. N80-12537
WANG, L. R. L. N80-12240
WANG, S. T. N80-12295
WANIC, M. N80-12589
WARMKE, J. M. N80-12107
WARN-VARNAS, A. N80-12378
WARNER, J. W. N80-12830
WARREN, M. N80-12586
WATERS, R. G. N80-12909
WATSON, K. N80-12521
WATSON, K. M. N80-12721
WATSON, R. L. N80-12843
WATTS, R. G. N80-12711
WEART, W. D. N80-12853
WEBBER, R. L. N80-12392
WEBER, D. N80-12291
WEEKS, R. G. N80-12945
WEICHEL, R. L. N80-12712
WEIHE, W. H. N80-12679
WEIHRAUCH, G. N80-12208
WEINSTEIN, S. N80-12607
WEISS, R. B. N80-12274
WEISSMAN, S. N80-12396
WENDIN, G. N80-12940
WENTZ, W. H., JR. N80-12053
WERLE, M. J. N80-12071
WERNER, A. S. N80-12637
WHIPPLE, E. C. N80-12883
WHITE, B. F. N80-12260
WHITE, R. M. N80-12666
WHITMAN, G. M. N80-12269
N80-12270
N80-12271
WIECZOREK, U. N80-12482
WIESEL, J. N80-12507
WIESNET, D. R. N80-12520
WILDUNG, K. L. N80-12768
WILKERSON, J. C. N80-12546
WILKINSON, M. K. N80-12598
WILKINSON, T. L. N80-12427
WILLENBERG, H. J. N80-12993
WILLIAMS, A. R. N80-12162
N80-12171
WILLIAMS, J. N80-12677
WILLIAMSON, R. B. N80-12143
WILLIAMSON, T. L. N80-12868
N80-12869
WILLIS, P. T. N80-12663
WILLSHIRE, W. L., JR. N80-12820
WILSON, W. K. N80-12447
WILTON, D. R. N80-12268
WINCEK, M. A. N80-12809
WINN, A. L. N80-12088
WINSTON, M. M. N80-12076
WIRZ, H. J. N80-12363
WITZE, P. O. N80-12400
WOLD, A. N80-12935
WOLF, S. W. D. N80-12356
WOLLMANN, E. N80-12208
WONG, D. N80-12609
WOOD, L. E. N80-12244
WOODS, D. C. N80-12663
WOODWARD, W. A. N80-12789
N80-12806
WRICK, V. L. N80-12285
WRIGHT, R. A. N80-12765
WRIGHTON, M. S. N80-12556
WU, C. M. M. N80-12280
WU, T. T. N80-12273
WUEBBLES, D. J. N80-12651
WYBORNY, W. N80-12039

Y

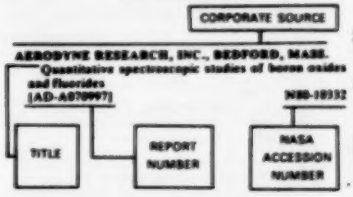
YABLONOVITCH, E. N80-12144
YAFFEE, P. N80-12957
YANG, K. H. N80-12933
YANG, T. Y. N80-12073
YAO, I. N80-12253
YEE, B. G. W. N80-12423
YEH, H. T. N80-12298
YEH, Y. C. M. N80-12549
YIN, L. I. N80-12185
N80-12189
YODER, J. A. N80-12535
YONCO, R. M. N80-12897
YOUNG, R. N80-12089
YUKUTAKE, T. N80-12653

Z

ZAGARINO, P. A. N80-12991
ZAGWODZKI, T. W. N80-12405
ZAHN, H. S. N80-12895
ZAJEC, E. N80-12149
ZARETSKY, J. L. N80-12930
ZECH, R. G. N80-12745
ZIERTEN, T. N80-12054
N80-12055
ZIMMERMAN, F. W. N80-12624
ZUCKERMAN, J. J. N80-12180

CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACADEMY OF SCIENCES [USSR], MOSCOW.
Climates of past geological epochs
N80-12670

AD-EX, PORTOLA VALLEY, CALIF.
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
[UCRL-TRANS-1570-PT-4/5] N80-12629

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NEUILLY-SUR-SEINE [FRANCE].
Propulsion and energetics panel working group 2 on aircraft fire safety. Volume 1: Executive summary
[AGARD-AR-132-VOL-1] N80-12079
The impact of global positioning system on guidance and controls systems design of military aircraft, volume 1
[AGARD-AR-147-VOL-1] N80-12082
Determination in ground facilites of aerodynamic stability parameters of aircraft
[AGARD-AG-242] N80-12102
AGARD bulletin technical programme, 1980
[AGARD-BULL-79/2] N80-12990

AEROCHEM RESEARCH LABS., INC., PRINCETON, N. J.
Kinetic spectroscopy of metal atom/oxidizer chemiluminescent reactions for laser applications
[AD-A073082] N80-12411

AERONAUTICAL RESEARCH LABS., MELBOURNE [AUSTRALIA].
Evaluation of wall interference effects in a two-dimensional transonic wind tunnel by subsonic linear theory
[ARL/AERO-REPT-151] N80-12062
Transonic wind tunnel tests on a series of two-dimensional aerofoils in a solid wall test section
[ARL/AERO-NOTE-384] N80-12063
Sea King Mk. 50 helicopter flight control system. A mathematical model of the AFCS [autostabilizer/autopilot mode]
[ARL/AERO-NOTE-387] N80-12099
A special crack tip element for three-dimensional crack problems
[ARL-STRUC-NOTE-374] N80-12436

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Inertia calculation procedure for preliminary design
[AD-A072679] N80-12087
Supersonic combustion, air dissociation through shock waves and aerodynamics of chemically reacting gases in a Planar converging - diverging nozzles
[AD-A073135] N80-12097

AEROSPACE CORP., EL SEGUNDO, CALIF.
A shock tube investigation of silo-launched vehicle aerodynamic flow asymmetries
[AD-A071811] N80-12110

AEROSPACE MEDICAL RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
Design of a microprocessor based cardiotachometer
[AD-A073105] N80-12731

AIR FORCE ACADEMY, COLO.
The USAF Academy flywheel-electric car preliminary design report
[AD-A071242] N80-12553

AIR FORCE AVIONICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Optical fringe analysis techniques, volume 1
[AD-A072714] N80-12868
Holographic spectral analysis
[AD-A072715] N80-12869

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FLA.
An evaluation of the bird/aircraft strike hazard at selected United Kingdom bases: RAF Mildenhall, RAF Alconbury, RAF Upper Heyford, RAF Bentwaters, RAF Fairford, RAF Lakenheath, and RAF Woodbridge
[AD-A073062] N80-12077

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
A method for assessing the impact of wake vortices of USAF operations
[AD-A072967] N80-12072

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Validation of the Detroit Diesel Allison logistic support cost model [program OS 590]
[AD-A072670] N80-12094
A parametric management tool for estimating simulator software size
[AD-A073015] N80-12768
Spectral analysis of time series
[AD-A072921] N80-12788
Reliability and maintainability analysis: A conceptual design model
[AD-A073120] N80-12949

AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO.
Evaluation of the use of corrosion inhibitors at the anodic oxide-metal interface
[AD-A073124] N80-12160

AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.
Metal-Nitride-Oxide-Semiconductor [MNOS] radiation characterization studies
[AD-A073637] N80-12287

AKADEMIYA NAUK SSSR, NOVOSIBIRSK.
Modeling of climatic changes and the problem of long-range weather forecasting
N80-12672

ALABAMA UNIV., UNIVERSITY.
Theoretical analysis of scattering of a laser beam from rough surfaces
[AD-A073129] N80-12871

ALASKA DEPT. OF COMMUNITY AND REGIONAL AFFAIRS, KENAI.
Characterization of initiation and detonation by Lagrange gage technology
[UCRL-13976] N80-12195

AMERICAN MATHEMATICAL SOCIETY, PROVIDENCE, R.I.
System theory as applied differential geometry
[NASA-CR-3209] N80-12776

AMERICAN UNIV., WASHINGTON, D. C.
On the properties of a fuel cell electrolyte
[AD-A072864] N80-12554
Adaptive procedures in analysis of variance
N80-12795

AMES LAB., IOWA.
Ultrapurification of reactive metals
[IS-M-167] N80-12168
Operational experience with drain-down solar systems
[IS-M-166] N80-12576
Photothermal conversion surface measurements using photoacoustic and photothermal spectroscopies
[IS-M-202] N80-12611
Applications of solid state nuclear magnetic resonance techniques to the study of coals and polymers
[IS-T-822] N80-12838
Hydrodynamic model wavefunctions in intrinsic coordinates and their application to the structure of even-even nuclei
[IS-T-825] N80-12847

ANALYTIC SCIENCES CORP., READING, MASS.
Analysis of some nuclear waste management options. Volume 1: Analysis and interpretation
[UCRL-13917-VOL-1] N80-12856

ANALYTICAL AND COMPUTATIONAL MATHEMATICS, INC., HOUSTON, TEX.
Orbit decay analysis of STS upper stage boosters
[NASA-CR-160385] N80-12103

ARGONNE NATIONAL LAB., ILL.
Design and development of an ultra-thin solenoid for a high energy physics particle detector
[CONF-780952-26] N80-12288
Argonne program to assess superconducting stability
[CONF-781055-3] N80-12295
World Energy Data System [WENDS] Volume 11: Nuclear fission program summaries
[ANL-PMS-79-2-VOL-11] N80-12562
Combined effects of polycyclic aromatic hydrocarbons and sunlight
[CONF-790447-4] N80-12631
Scattering of MeV neutrons from elemental iron
[ANL/NDM-47] N80-12841
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A073128] N80-12882
Current status of fusion reactor blanket thermodynamics
[ANL-78-109] N80-12897
Energy level structure and transition probabilities in the spectra of the trivalent lanthanides in LaF3
[ANL-78-XX-95] N80-12936
Supercell calculations of positron trapping and annihilation at vacancies in simple and transition metals
[CONF-790437-7] N80-12941

ARINC RESEARCH CORP., ANNAPOLIS, MD.
Control of ELT false alarms
[NASA-CR-162502] N80-12255

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, ABERDEEN PROVING GROUND, MD.
Effect of horizontal and vertical side forces and moments on stability of a symmetric missile in ascending or descending flight
[AD-A072808] N80-12067

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, DOVER, N. J.
Dynamic model of water deluge system for propellant fires
[AD-A071457] N80-12190

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, WATERVLIET, N. Y.
Abrasive machining of major components
[AD-A071916] N80-12415

ARMY AVIATION TEST ACTIVITY, EDWARDS AFB, CALIF.
AH-1G lateral flight performance test
[AD-A072866] N80-12088

ARMY COMMUNICATIONS RESEARCH AND DEVELOPMENT COMMAND, FORT MONMOUTH, N. J.
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 2: Numerical evaluation
[AD-A072998] N80-12269
Scattering from periodic surfaces with sinusoidal height profile. A theoretical approach. Part 1: Theory
[AD-A072984] N80-12270
A rigorous theory for plane wave scattering from periodic trapezoidal metal surfaces
[AD-A072983] N80-12271

ARMY CONSTRUCTION ENGINEERING RESEARCH LAB., CHAMPAIGN, ILL.
Durability and fire-spread aspects of plastic pipe systems
[AD-A073031] N80-12143

ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND, FORT MONMOUTH, N. J.
Acoustic waves in cubic crystals networks for semiconducting vibrators, and applications to gallium arsenide
[AD-A072764] N80-12936

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The 19304DT GSRS, missile no. 1031, round no. V-46
[AD-A073388] N80-12699
The 14818C Lance, missile number 3396, round number 333 APL
[AD-A073109] N80-12701

The 1970I2A GSRS, missile number 336, round number B-19
[AD-A073110] N80-12702
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[AD-A073111] N80-12703
The 1930SAT GSRS, missiles number 1042, 1039, rounds number V-44, V-45
[AD-A073112] N80-12704
The 1930SAT GSRS, missile number 1040, round number V-43
[AD-A073108] N80-12705

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[AD-A072742] N80-12825

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[AD-A072692] N80-12751

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[AD-A073456] N80-12075
Minicomputer applications in automated testing of electro-optical guidance systems
[AD-A072003] N80-12407

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Electrical overstress program
[AD-A073148] N80-12422

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[AD-A072817] N80-12179

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[AD-A072685] N80-12377

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[AD-A073451] N80-12074

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[AD-A072827] N80-12700

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[AD-A073187] N80-12706

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[RHO-LD-44] N80-12858

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N80-12007

B

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[EPRI-FP-1028] N80-12192

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Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops
N80-12497

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[AD-A072826] N80-12089
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[NASA-CR-162606] N80-12107
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[NASA-CR-162454] N80-12958

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[PNL-SA-6831-PT-2] N80-12573
Statistical methods for evaluating sequential material balance data
[NUREG-CR-0683] N80-12809
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[PNL-2823] N80-12993

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[SAND-79-8187] N80-12608

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[AD-A073095] N80-12951

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[NASA-CR-161329] N80-12538
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[NASA-CR-161331] N80-12540

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N80-12796

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[BNL-26068] N80-12940

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[AD-A072762] N80-12784
Spline approximations for functional differential equations
[AD-A072763] N80-12785
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N80-12685

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N80-12510

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N80-12344
Application of porous media to heat storage underground
N80-12345

C

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Structure of some refractory transition metal metalloid glasses
[CALT-422-105] N80-12162
Structure and properties of transition metal-metalloid glasses based on refractory metals
[CALT-422-107] N80-12171
Leading edge flutter of supercavitating hydrofoils
[AD-A073382] N80-12234
Numerical methods for hyperbolic partial differential equations
N80-12359
Chemical reactions in turbulent mixing
[AD-A073746] N80-12379
A global geochemical model for the evolution of the mantle
[NASA-CR-162902] N80-12644
Cascade of negative muons in stones
[CALT-63-300] N80-12844

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[AD-A069010] N80-12721

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Operation of a high-current xenon source
[LBL-8859] N80-12149
Germanium field-effect transistor made from a high-purity substrate
[LBL-8134] N80-12294
Air-to-air heat exchangers: Saving energy and improving indoor air quality
[LBL-9381] N80-12380
Experimental test facility for evacuation of solar control strategies
[LBL-8308] N80-12586
Residential on site solar heating systems. A project evaluation using the capital asset pricing model
[LBL-8298] N80-12588
Analysis of the California solar resource, volume 2
[LBL-7860-VOL-2] N80-12589
Measurements of indoor air conditioned environments and practical evaluations of intake of atmospheric air. Part 4: Comparison of measurement results and simulation results. Part 5: Studies of simulation methods for optimal design of air-conditioned environments.
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Circumsolar radiation data for central receiver simulation
[LBL-8371] N80-12647
Analysis of measured values for the state of stress in the earth's crust
[LBL-7071] N80-12648
Structure of the earth's crust and upper mantle plotted from data of seismic studies
[UCRL-TRANS-11392] N80-12650
Routine spectral measurements of infrared radiation from the atmosphere
[LBL-8777] N80-12652
Directions for memory hierarchies and their components: Research and development
[LBL-8276] N80-12752
The experimental superconducting synchrotron [ESCAR]
[LBL-8211] N80-12836
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[LBL-9948] N80-12845
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[UCRL-82051] N80-12124
Shock initiation and detonation models in one and two dimensions
[UCID-18024] N80-12194
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[UCRL-81841] N80-12201
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401
OASIS: A general purpose mesh generator for finite element codes
[M-101] N80-12449
Application of a method for comparing one-dimensional and two-dimensional models of a ground-water flow system
[UCRL-52541] N80-12545
Hybrid staging of geothermal energy conversion processes
[UCID-17949] N80-12569
New concepts for converting the energy in low-to medium-temperature liquids, with emphasis on geothermal applications
[UCRL-52583] N80-12570
Notes from the Second Department of Energy Library Workshop
[UCRL-81736] N80-12584
Mechanical energy storage technology development for electric and hybrid vehicle applications
[UCRL-81786] N80-12596
Numerical modeling of LNG spill phenomena
[UCRL-82031] N80-12625
ATMAS: A three-dimensional atmospheric transport model to treat multiple area sources
[UCRL-52603] N80-12627
Environmental aspects of alternative energy technologies for California
[UCRL-15002] N80-12628
Predictions of the effects on the stratosphere of changes in the oxides of nitrogen
[UCRL-82553] N80-12651
Regional wind-field study in complex terrain during summer sea-breeze conditions
[UCRL-52680] N80-12712
Electrostatics, small particles, and laser fusion targets
[UCRL-81537] N80-12834
High-pressure and high-temperature behavior of simple and complex molecular liquids
[UCRL-82129] N80-12839
Research on the annular lithium jet concept for future laser-fusion reactors
[UCRL-13938] N80-12852
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[NUREG-CR-0579] N80-12855
Actinide cross section data and inertial confinement fusion for long term waste disposal
[UCRL-82177] N80-12859
Preliminary area selection considerations for radioactive waste repositories in bedded salt
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TOFS - A Timing Optical Fiber System
[UCRL-81973] N80-12873
Brillouin scatter in a hydrodynamic simulation
[UCRL-82793] N80-12874
Tandem mirror fusion reactor studies
[UCID-17990] N80-12886
Superconducting magnets for mirror machines
[UCRL-81578] N80-12892
Search for fusion power
[UCRL-81890] N80-12900
Radial diffusion of resonant particles in tandem mirrors
[UCID-17992] N80-12902
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[UCRL-81936] N80-12903
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N80-12431
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[AD-A072774] N80-12448
Design and measurement of implementation schemes for retention storage management as utilized in block structured languages
N80-12762
Intervalley transfer in n-type germanium at 77 deg K
N80-12928

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[PB-298266/8] N80-12241
Analytical procedures in soil dynamics
[PB-298445/8] N80-12242
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[PB-298262/7] N80-12450
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[PB-298267/6] N80-12451

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N80-12618
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N80-12801
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N80-12914

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[PB-298577/6] N80-12775
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[AD-A073160] N80-12983

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N80-12638
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[AD-A073029] N80-12771

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[AD-A072791] N80-12069

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N80-12369

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Electroless [chemiphoretic] deposition of polymer latex on a rapidly-dissolving steel substrate
N80-12141
Guided wave acoustooptic devices for wideband real-time signal processing
N80-12253
Spreading kinetics of a liquid drop on a solid surface
N80-12307
Recommended plan for project FRACT: A critical evaluation of fracture related analytical and computational techniques
[AD-A072773] N80-12447
Foam solar sea power: A physical investigation
N80-12548
Building and exploiting user models
N80-12743
Compiling customized executable representations and interpreters
N80-12744

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[NASA-CR-159703] N80-12259

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N80-12684

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[AED-CONF-78-212-011] N80-12614

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N80-12216
Reliability performances of systems with a switching matrix
N80-12217
Performance and impairments in a QPSK satellite to ground link
N80-12218
Synchronization procedures for a regenerative SS-TDMA system
N80-12219
The telecommunication satellite as an integrated time division transmission-switching system
N80-12220
Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits
N80-12221
An approach to blocked aperture synthesis
N80-12222
Analysis and synthesis of corrugated conical horns
N80-12223
A method for computing corrugated horns phase center
N80-12224
Analysis and synthesis of an elliptical paraboloid offset reflector antenna. An elliptically shaped beam antenna
N80-12225
Analytical and graphical methods for the design of an elliptically shaped beam antenna with elliptical paraboloid reflector
N80-12226
An elliptically shaped beam antenna
N80-12227
Reflector antennas with high efficiency and low depolarization
N80-12228
Some considerations about sky noise temperature at frequencies above 10GHz
N80-12229
Bit rate reduction by automatic adaptation of quantizer step-size in DPCM systems
N80-12230
An adaptive quantizer with channel error recovery
N80-12231
Design of instantaneously companded delta modulators with M-bit memory
N80-12232
Evaluation of adaptive speech coders under noisy channel conditions
N80-12233
An adaptive delta modulator robust to transmission errors
N80-12234
Transform coding of PAL composite signals
N80-12235

CHEMSOIL CORP., BAKERSFIELD, CALIF.
Simultaneous stack gas scrubbing wastewater purification
[NASA-CR-160290] N80-12620

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[PB-298556/2] N80-12654

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[AD-A072673] N80-13071

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Target factor analysis of gas-chromatographic retention indices
N80-12129
Solutions of Prandtl's boundary layer equations using linear programming and mappings
N80-12302
Effects of uniaxial stress on excitons in cuprous oxide
N80-12909
Cosmological tests of a scale covariant theory of gravitation
N80-12976

CIVIL AERONAUTICS BOARD, WASHINGTON, D.C.
Federal Aviation Act of 1958
N80-12954

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N80-12691

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N80-12155
The 360 deg light scattering photometer for single particle analysis
N80-12865
Studies in surface structure by means of surface viscosity
N80-12908

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N80-12154

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N80-12360

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[AD-A072884] N80-12783
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[AD-A072835] N80-12786

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N80-12131
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N80-12280
Collision and photofragmentation dynamics of IR laser pumped methyl fluoride and carbonyl fluoride
N80-12404

A contribution to the design and analysis of precast prestressed shells of revolution under symmetric and unsymmetric loads
N80-12429
Buckling and post-buckling behavior of elasto-plastic structures
N80-12430
Quality considerations in a programming language
N80-12760
The design and analysis of a parallel processing language
N80-12761
Good functions, elementary sets and automata
N80-12813
Directional distributions of beta-rays emitted from oriented nuclei
N80-12849
Thermonuclear burn in wall-confined plasmas [CCO-3456-60]
N80-12905
A study of the optical and transport properties of the ternary semiconducting compounds AlxGa1-xAs
high pressure
N80-12911
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N80-12915
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N80-12612
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N80-12349
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N80-12550
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N80-12395
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N80-12683
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N80-12318
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Temperature distortion
N80-12332
Unsteady pressure distortion
N80-12333

D

DATA/WARE DEVELOPMENT, INC., SAN DIEGO, CALIF.
Advanced digital TV system [AD-A072917]
N80-12274
DAYTON UNIV., OHIO.
Development of stability methods for application to nonlinear aeroelastic optimization
N80-12052
A penalty function approach for the nonlinear finite element analysis of thin shells
N80-12432
DAYTON UNIV. RESEARCH INST., OHIO.
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N80-12095
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N80-12550
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N80-12582
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N80-12583
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N80-12899
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N80-12964
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N80-12001
Aeroelasticity from the viewpoint of the designer
N80-12002
Modal analysis of aircraft structures
N80-12003
Lifting surface divergence and control effectiveness
N80-12004
Unsteady aerodynamic inputs for aeroelastic analyses: A general introduction
N80-12008
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N80-12467
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N80-12468
Future remote sensing program of the DFVLR
N80-12470
Aerial photography of agricultural farming land
N80-12496
What are the advantages of multispectral classification?
N80-12501
Interactive correction of classified photographs
N80-12503
Development of processing methods for images of the Jade coast region and experience acquired
N80-12504
Effect of radiometric parameters on remote sensing images
N80-12514
DEUTSCHER WETTERDIENST, OFFENBACH AM MAIN [WEST GERMANY].
A method for evaluating infrared images taking photography, vegetation coverage and buildings into consideration
N80-12486
DEUTSCHES HYDROGRAPHISCHES INSTITUT, HAMBURG [WEST GERMANY].
Scanner coordination problems: Images from over the sea
N80-12473
Numerical treatment of IR thermal data for the German Bight test region
N80-12474
Research into determining chemical parameters at the surface of the sea by remote sensing
N80-12479
Determination of the optical properties of the sea in the German bight
N80-12516
DREXEL UNIV., PHILADELPHIA, PA.
Double-exposure collector system [TID-28964]
N80-12593
DUKE UNIV., DURHAM, N. C.
A comparison of the Lixiscope with other X-ray imaging systems
N80-12390
DYNATECH CORP., CAMBRIDGE, MASS.
Cost analysis of aquatic biomass systems [HCP/ET/4000-78/1]
N80-12202

E

ECOLE CENTRALE DE LYON [FRANCE].
Pathological cases in turbulent field and spectral approach
N80-12321
EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA, CALIF.
Characterization of microchannel plate photomultipliers for plasma diagnostics [S-129-TP]
N80-12891
EHRENKRANTZ GROUP, NEW YORK, N. Y.
Architectural concerns in solar system design and installation [SOLAR/0801-79-01]
N80-12607
EIC, INC., NEWTON, MASS.
Investigations of the safety of Li/SOCl sub 2 batteries [AD-A072862]
N80-12595
ELECTRICITE DE FRANCE, CHATOU.
Application of data acquisition system for on site measurements of wind effects on structures
N80-12357
ELECTRO ENGINEERING WORKS, SAN LEANDRO, CALIF.
Study program for constant current capacitor charging method [UCRL-13914]
N80-12297
ELECTRONIC TECHNIQUES, INC., FORT COLLINS, COLO.
Sierra Cooperative Project [SCPP] forecasting support, volume 1 [PB-294497/9]
N80-12714
ELECTRONICS ENGINEERING GROUP [1842ND], SCOTT AFB, ILL.
Line Access Test System [LATS] [AD-A072768]
N80-12750
ELECTRONICS RESEARCH LAB., ADELAIDE [AUSTRALIA].
The frequency response of a particular gimbal system to coherent rotation and acceleration excitation [AD-A073153]
N80-12081
The measurement of temperature instabilities and their effect on the liquid phase epitaxial growth of gallium arsenide [ERL-0077-TR]
N80-12931
ENERGY UTILIZATION SYSTEMS, INC., PITTSBURGH, PA.
Research and development of a heat and pump water heater, volume 1 [ORNL/SUB-7321-1]
N80-12613
ENGINEERING SCIENCE AND SYSTEMS CORP., SAN DIEGO, CALIF.
Assessment of procedures and preliminary software design for fault tree synthesis [UCRL-13919]
N80-12773
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
Proceedings of the Workshop on Alternatives for Cadmium electroplating in Metal finishing [PB-294341/6]
N80-12173
ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.
A study of the tolerance block approach to special stratification [E80-10027]
N80-12529
ENVIRONMENTAL SCIENCES RESEARCH LAB., RESEARCH TRIANGLE PARK, N.C.
Optimized chemiluminescence system for measuring atmospheric ammonia [PB-294248/6]
N80-12633
ERNST AND ERNST, WASHINGTON, D. C.
Development of a joint-cost-allocation manual for Integrated Community Energy Systems [ICES] [ANL/ICES-TM-20]
N80-12581
EUROPEAN SPACE AGENCY, PARIS [FRANCE].
Contributions to gas dynamics and aerodynamics [ESA-TT-518]
N80-12035
On the simulation of an underexpanded propulsive jet for the wind tunnel investigation of the static longitudinal stability of flight vehicles in supersonic flow
N80-12036
The normal force on a cruciform missile at bank angles of a deg and 45 deg
N80-12037
Influence of the flow field around an inclined ogive-cylinder body upon supersonic aft-intakes
N80-12038
Normal force derivative and center of pressure movement due to Mach number on wing-body combinations with triangular wings of the same span and different aspect ratios at supersonic speeds
N80-12039
Flow field investigations in corner regions in hypersonic flow
N80-12040
Laser-Raman spectroscopy
N80-12041
Determination of atmospheric density, temperature and pressure profiles for winter anomalous conditions at heights between 52 and 117 km
N80-12042
Similarity in nozzle flows with vibrational nonequilibrium
N80-12043

Mixing length model for compressible turbulent flows in rough channels
N80-12044
Curvature effects on the behavior of laminar boundary layers
N80-12045
Verification of the experimentally determined laminar-turbulent transition on a swept wing
N80-12046
A computational method for calculating laminar-turbulent transition in a boundary layer
N80-12047
Higher-order boundary layer equations for three-dimensional compressible flow
N80-12048
Three-dimensional, inviscid, rotational duct flows with embedded shocks: Considerations with regard to a computational method and preliminary results
N80-12049
Shock-shock and shock-boundary layer interaction at flat and inclined plates in rarefield hypersonic flow
N80-12050
Construction problems for high Reynolds number wind tunnel models
[ESA-TT-564] N80-12101
On the probability of crack propagation in a unidirectional composite with a single fiber breakage
[ESA-TT-524] N80-12125
Influence of turbulence on hydrocarbon combustion in a stirred combustor
[ESA-TT-580] N80-12151
Background storage management in operating systems for communications computers
[ESA-TT-504] N80-12755

F

FLORIDA STATE UNIV., TALLAHASSEE.
Surface meteorology over the gate a-scale
[REPT-78-6] N80-12658
Laboratory modelling of oceanic response to monsoonal winds
[TR-15] N80-12659
FOREIGN RESOURCES ASSOCIATES, FORT COLLINS, COLO.
Experience with permanent modification of aluminum-silicon cast alloys
[RFP-TRANS-250] N80-12166
Incompatibility of sodium and antimony in the treatment of aluminum, silicon alloys
[RFP-TRANS-256] N80-12167
FORSCHUNGSGRUPPE FUER INFORMATIONSVERARBEITUNG UND MUSTERERKENNUNG, KARLSRUHE [WEST GERMANY].
Digital processing procedure for texture analysis with remote sensing data
N80-12505
FORSCHUNGSINSTITUT SENCKENBURG, FRANKFURT [WEST GERMANY].
Studies of thermal diffusion processes near cooling water inlets in a banked river [lower Main]
N80-12492
FRANKLIN INST. RESEARCH LABS., PHILADELPHIA, PA.
The great adventure. A report on the 10 regional public hearings on solar energy for the domestic policy review
[HCP/U6354-01] N80-12567
FREIBURG UNIV. [WEST GERMANY].
International cooperation in remote sensing
N80-12471
Interaction between air and surface temperatures during the course of a day as a function surface types and relief
N80-12487
Possibility of obtaining information on cold air concentrations and movements from thermal images
N80-12488
Thermal images and climatic changes in regrouped vineyards on mountain slopes
N80-12489
Large scale thermal images as a means of distinguishing between building structures in a town
N80-12490
Interpretation of water quality using remote sensing techniques
N80-12493
Texture analysis as a recognition parameter for different types of forests
N80-12498
Phenology as a factor in the determination of different forms in vegetation by remote sensing
N80-12499
Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry
N80-12500
Correspondance problems in polygonal segmented multispectral digital images
N80-12508
Spectral reflection from agricultural and forest regions during the vegetation period
N80-12513
The multispectral scanner as an instrument for signature determinations
N80-12515

G

GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
Better information management policies needed: A study of scientific and technical bibliographic services
[PB-298776/6] N80-12953
GENERAL ATOMIC CO., SAN DIEGO, CALIF.
Thermal-hydraulic considerations in magnetically confined fusion reactors
[GA-A-15365] N80-12896
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
Wind tunnel investigation of an oblique wing transport model at mach numbers between 0.6 and 1.4
[NASA-CR-137697] N80-12059
GENERAL DYNAMICS CORP. FORT WORTH, TEX.
The criticality of engine exhaust simulations on VSTOL model-measured ground effects
[AD-A073114] N80-12093
Optimization of computer automated ultrasonic inspection system
[AD-A072677] N80-12423
GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
Commercial application of molten carbonate fuel cell system
[CONF-790213-4] N80-12557
GENERAL ELECTRIC CO., ST. PETERSBURG, FLA.
Replication technique for examining defects in the interface of a metal-to-glass ceramic bond
[GEPP-TIS-391] N80-12182
GENERAL RESEARCH CORP., MCLEAN, VA.
Analysis to determine functional and systems requirements for an on-line Structure and Composition System [SACS]
[AD-A072947] N80-12950
GEOLOGICAL SURVEY, DENVER, COLO.
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[E80-10005] N80-12521
GEOLOGICAL SURVEY, LAWRENCE, KANS.
Guidelines for the use of structural versus regression analysis in geomorphic studies
[PB-298360/9] N80-12655
GEOLOGICAL SURVEY, RESTON, VA.
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] N80-12547
GEORGE WASHINGTON UNIV., WASHINGTON, D. C.
A separable programming approach to the linear complementarity problem
[AD-A072928] N80-12767
GEORGIA INST. OF TECH., ATLANTA.
On some new general and complementary energy theorems for the rate problems in finite strain, classical elasto-plasticity
[AD-A072969] N80-12444
Rate complementary energy principles finite strain plasticity problems and finite elements
[AD-A072970] N80-12446
Guiding the development of a controlled ecological life support system
[NASA-CR-162452] N80-12735
Evaluation of a ground based manned demonstration as a milestone in CELSS development
N80-12736
Development requirements for a successful ground based CELSS demonstration
N80-12737
Research recommendations
N80-12738
GIBBS AND COX, INC., WASHINGTON, D. C.
Ocean Thermal Energy Conversion [OTEC] platform configuration and integration, executive summary
[DOE/ET-4064-1] N80-12600
GINER, INC., WALTHAM, MASS.
Study of corrosion and its control in aluminum solar collectors
[COO-2934-7] N80-12609
GULF UNIVERSITIES RESEARCH CONSORTIUM, BELLAIRE, TEX.
Naturally occuring carbon dioxide sources in the United States. A geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery
[FE-2025-38] N80-12624
GUTEHOFFNUNGSHUETTE STERKRADE A.G. OBERHAUSEN [WEST GERMANY].
Electric power generation and LNG evaporation with the aid of gas turbines within a closed-cycle process
[AED-CONF-78-155-010] N80-12291

H

HAMBURG UNIV. [WEST GERMANY].
On the problem of the remote sensing of substances in water by multispectral scanning
N80-12478
HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH.
Materials compatibility in liquid sodium
[HEDL-SA-1559] N80-12147
HARRIS CORP., MELBOURNE, FLA.
Cross polarization interference reduction techniques
[AD-A072748] N80-12266
Optical mass memory investigations. Volume 3: Considerations for the development of a DIGIMEM archival optical mass storage system
[NASA-CR-162460] N80-12745
HARRY DIAMOND LABS., ADELPHI, MD.
Hemp study of planned DAS3 configuration
[AD-A072948] N80-12265
The infinite parallel-wire array over a ground plane: A code for an EMP vulnerability assessment and hardening program
[AD-A073103] N80-12770
HARVARD UNIV., CAMBRIDGE, MASS.
Quasicontinuum physics
[AD-A073117] N80-12144
Scattering of electromagnetic waves by obstacles in presence of the earth's surface current distribution on perfectly conducting cylindrical loops in an incident
[AD-A072880] N80-12273
Vibration-torsion interaction in the microwave spectrum of methyl malonaldehyde
N80-12831
HAWAII UNIV., HONOLULU.
Summer weather on Haleakala, Maui
[UHMET-79-09] N80-12708
HOWARD, NEEDLES, TAMMEN, AND BERGENDOFF, FAIRFIELD, N. J.
Bridge deck joint-sealing system: Evaluation and performance specification
[PB-298942/4] N80-12184
HOWARD UNIV., WASHINGTON, D. C.
Theoretical calculations and instrument development and test characterization of low intensity X-ray imaging devices
N80-12387
Orthopedic evaluation
N80-12391
HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
Detection of different target types in realistic terrain
[AD-A072973] N80-12733

I

IBADAN UNIV. [NIGERIA].
Climatic variability and land use: An African perspective
N80-12686
IBM FEDERAL SYSTEMS DIV., HUNTSVILLE, ALA.
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[SOLAR/0010-78-10] N80-12585
IDAHO NATIONAL ENGINEERING LAB., IDAHO FALLS.
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[TFBP-TR-292] N80-12164
Long-term bearing wear tests of conventional journal bearings and development of hydrostatic bearings for the LOFT drag-disc turbine transducer
[LTR-141-101] N80-12420
ILC TECHNOLOGY, INC., SUNNYVALE, CALIF.
Laser pump lamps
[AD-A072704] N80-12409
ILLINOIS UNIV. AT CHICAGO CIRCLE, CHICAGO.
Bond stress-slip relationship and cracking response of reinforced concrete composite
[PB-297744/5] N80-12452
Fracture behavior and analysis of fiber reinforced concrete beams
[PB-297743/7] N80-12453
Eigenvalue bounds and stability of conservative fluid and plasma flows
N80-12875
Low temperature specific heat of nickel-copper alloys in various magnetic fields
N80-12916
ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
Initiation, combustion and transition to detonation in homogeneous and heterogeneous reactive mixtures
[AD-A073058] N80-12146
Performance of continuously reinforced concrete pavement in Illinois
[PB-298495/3] N80-12249
Burst processing
[AD-A072872] N80-12807
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON [ENGLAND].
Models for turbulent flows with variable density and combustion
N80-12323
INDIAN INST. OF TECH., BOMBAY.
Thermal stresses in non-homogeneous shells of revolution: Theory and analysis
[IIT-B/CE-79-2] N80-12437
INSTITUT DE RECHERCHE D'INFORMATIQUE ET D'AUTOMATISME, ROQUENCOURT [FRANCE].
Some aspects of the approximation of free surface problems
N80-12360

INSTITUT FRANCO-ALLEMAND DE RECHERCHES, ST. LOUIS [FRANCE].
Contributions to ballistics, detonations, and pulse physics
[BMVG-FBWT-79-01] N80-12205
Detonation of nitromethane-Al-NO2 mixtures
N80-12206
The use of Hamiltonian quaternions for determining the translational and rotational motion of a projectile
N80-12207
Miscellanea concerning terminal ballistics
N80-12208
The use of holography for kinetic energy measurements of target splinters
N80-12209
The development of passive Doppler techniques in LRSL/TSL and their applications to ballistic and aerodynamic measurements
N80-12210
Shock tube research looking at the origin of the Mach waves inside and outside supersonic jets
N80-12211
Analysis of the structure deformation of sodium chloride submitted by a shock wave
N80-12212
Transient interactions of laser pulses with matter
N80-12213
Experimental studies of laser induced detonation waves
N80-12214
Fuming of spark discharges
N80-12215
Contribution to fluid mechanics and ballistics
[BMVG-FBWT-79-3] N80-12310
Velocity measurements on propellant gases in gun tubes
N80-12311
Laser anemometer measurements in a supersonic free jet with a hot gaseous envelope
N80-12312
Dimensions of a coherent structure in the potential cone of a subsonic free jet
N80-12313
Digital data acquisition systems for laser-Doppler-anemometry: Problems and developments demonstrated with the aid of instruments built-up at the ISL
N80-12314
Data acquisition and transmission from highly accelerated ballistic missiles of small and medium caliber
N80-12315
Measurements in interior ballistics, transmission, sensors
N80-12316

INSTITUT FUER ANGEWANDTE GEODAESIE, FRANKFURT AM MAIN [WEST GERMANY].
Information relative to cartography and geodesy. Series 2: Translations
[REPT-36] N80-12455
Auto- and cross-correlation of image coordinates
N80-12456
Geometrical analysis and rectification of LANDSAT MSS imagery: Comparison of different methods
N80-12457
A study in the determination of depth information from underwater acoustical scanners
N80-12458
Effect of aircraft attitude changes on image geometry of linear array sensors
N80-12459
Height interpolation by the method of finite elements
N80-12460
Bundle adjustment with field and self calibration: Recent results
N80-12461
Progress in photogrammetric point determination by compensation of systematic errors and detection of gross errors
N80-12462
On-line aerial triangulation with the PLANICOMP C-100 analytical stereoplotting system
N80-12463
Block-adjustment programs for minicomputers
N80-12464
Automatic data acquisition for digital height model
N80-12465
Texture analysis by means of synthetic impulse functions
N80-12466

INSTITUT FUER ANGEWANDTE GEODAESIE, SINGLINGEN [WEST GERMANY].
The determination of land usages for planning and cartography
N80-12517

INSTITUT FUER PHYSIKALISCHE WELTRAUMFORSHUNG, FREIBURG [WEST GERMANY].
Determination of spectral signatures by radiometric ground measurements [evaluation and problems]
N80-12511
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
N80-12512

INSTITUTE FOR ENERGY ANALYSIS, OAK RIDGE, TENN.
Constraints on energy conservation
[ORAU/IEA-78-17[M]] N80-12594
Fundamental aspects of energy conservation policy
[ORAU/IEA-79-20[M]] N80-12595
Climatic models and the prediction of CO2-induced climatic changes
[ORAU/IEA-79-24-[M]] N80-12711

INSTITUTE FOR LOCAL SELF RELIANCE, WASHINGTON, D. C.
The great adventure: A report on the 10 regional public hearings on solar energy for the domestic policy review
[HCP/U6354-01] N80-12567

INSTITUTE FOR TELECOMMUNICATION SCIENCES, BOULDER, COLO.
Statistical methods for estimating time and rate parameters of digital communication
[PB-297971/1] N80-12277
Ground wave propagation over irregular, inhomogeneous terrain: Comparisons of calculations and measurements
[PB-299668/5] N80-12278

INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.
Status of the PEATGAS process
[CONF-781005-3] N80-12199
HYGAS process update
[CONF-781005-4] N80-12200
Commercial application of molten carbonate fuel cell system
[CONF-790213-4] N80-12557

INSTITUTE OF MAN AND SCIENCE, RENSSELAERVILLE, N. Y.
Position paper on the potential of inadvertent weather modification of the Florida Peninsula resulting from neutralization of space shuttle solid rocket booster exhaust clouds
[NASA-CR-3091] N80-12642

INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS [BRAZIL].
Preliminary analysis on the potential value of LANDSAT images for a desertification study
[E80-10003] N80-12519

INTERMETRICS, INC., LONG BEACH, CALIF.
Programming in HAL/S
[NASA-CR-162501] N80-12766

INTERNATIONAL BUSINESS MACHINES CORP., HOPEWELL JUNCTION, N. Y.
Lifetime control in silicon through focused laser beam damage
[AD-A073052] N80-12933

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG [AUSTRIA].
Energy and climate: A review with emphasis on global interactions
N80-12677

INTERNATIONAL NICKEL CO., INC., SUFFERN, N. Y.
Evaluation of high chromium overplays to protect low alloyed substrates from corrosion in a coal gasification atmosphere
[FE-2621-3] N80-12163

INTERTECHNOLOGY CORP., WARRENTON, VA.
Photosynthesis energy factory: Analysis, synthesis, and demonstration
[HCP/T3568-01] N80-12587

IONICS, INC., WATERTOWN, MASS.
Anion permselective membrane
[NASA-CR-159599] N80-12551

IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
The methanation reaction on ruthenium thin films: A mechanistic investigation
N80-12128
Thermodynamic study of liquid cerium and copper alloys by levitation calorimetry
N80-12158
Turbomachine wake transport and interaction
N80-12329
Field methods for determining nitrous oxide fluxes over soil
N80-12617
A regional approach to forecasting electric energy requirements for environmental assessments
N80-12619
The crystal and molecular structure of some high coordination rare earth compounds, the magnetic and structural properties of some rare-earth-transition-metal compounds, and use of radial distribution functions in structural analysis
N80-12907
Magnetic and electronic properties of Nd-La and Ce-La alloys
N80-12927
Lattice dynamics of hcp and bcc zirconium
N80-12930

IOWA UNIV., IOWA CITY.
Intense electrostatic waves near the upper hybrid resonance frequency
N80-12640
Language recognition and the synchronization of cellular automata
N80-12759
Improved estimations under restricted parameters spaces
N80-12802
On rings with self-duality
N80-12811
Non-markovian theory of strong turbulence
N80-12876
X-ray diffraction study of the alloy system $SmP_xS_{(1-x)}$
N80-12926
On the acceleration of energetic protons by interplanetary shock waves
N80-12975

J

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Method for shaping and aiming narrow beams
[NASA-CASE-NPO-14632-1] N80-12256
Optical gyroscope system
[NASA-CASE-NPO-14258-1] N80-12383
Schottky barrier solar cell and method of fabrication
[NASA-CASE-NPO-13689-2] N80-12549
Geological assessment probe
[NASA-CASE-NPO-14558-1] N80-12642
Simultaneous muscle force and displacement transducer
[NASA-CASE-NPO-14212-1] N80-12730

JOHNS HOPKINS UNIV., BALTIMORE, MD.
Matching algorithms
N80-12757
Measuring inter-rater reliability of dichotomous responses: A components of variance approach
N80-12797

JOHNS HOPKINS UNIV., LAUREL, MD.
Computation of water waves
[AD-A072944] N80-12375

K

KANNER (LEO) ASSOCIATES, REDWOOD CITY, CALIF.
Theory of interstitial ordering in alloys with hexagonal close-packed crystal lattice
[IS-TRANS-106] N80-12937

KANSAS DEPT. OF TRANSPORTATION, TOPEKA.
An evapo-transmission method for determining relative permeability of concrete
[PB-298323/7] N80-12251

KANSAS STATE UNIV., MANHATTAN.
Extensions of functions in Sobolev and Besov spaces
N80-12812

KANSAS UNIV., KANSAS CITY.
Assist of an air-to-air heat pump using solar heated hot water
N80-12413

KANSAS UNIV., LAWRENCE.
The development of the DAST 1 remotely piloted research vehicle for flight testing an active flutter suppression control system
N80-12083
Ion electrodes selective for organic functional groups
N80-12114

KANSAS UNIV. CENTER FOR RESEARCH, INC., LAWRENCE.
An improved Woodward's panel method for calculating leading-edge and side-edge suction forces at subsonic and supersonic speeds
[NASA-CR-3205] N80-12061

KARLSRUHE UNIV. [WEST GERMANY].
Turbulence models for environmental problems
N80-12319
Transport phenomena in packed bed reactors
N80-12339
Determination of the characteristics of diffusion processes at cooling water inlets in the Rhine and Main
N80-12491
Application of a hierarchial classification method for special problems
N80-12502
Evaluations in the framework of the FMP program using the digital image processing system DIDAK
N80-12507

KERNFORSCHUNGSZENTRUM, KARLSRUHE [WEST GERMANY].
Direct numerical simulation of turbulence
N80-12320

KYOTO UNIV. [JAPAN].
Climatic variability and agriculture in tropical moist regions
N80-12682

L

LABORATOIRES DU CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE, MOL [BELGIUM].
Influence of an obstruction on fluid-particle heat-transfer in a packed bed
N80-12350

LANDESKULTURAMT HESSEN, WIESBADEN [WEST GERMANY].
Classification of agricultural land with the aid of remote sensing methods
N80-12495

LEAGUE OF WOMEN VOTERS, WASHINGTON, D. C.
Energy conservation technology education program
[HCP/M2165] N80-12606
LEHIGH UNIV., BETHLEHEM, PA.
Preparation and characterization of latexes
N80-12115
LIBRARY OF CONGRESS, WASHINGTON, D. C.
Weather modification: Programs, problems, policy, and potential
[GPO-34-857] N80-12680
LIEGE UNIV. [BELGIUM].
Aircraft flutter and dynamic response
N80-12010
The application of turbulence models to geophysical flows: Turbulence in the ocean
N80-12322
Steady pressure distortions
N80-12330
LIFE SYSTEMS, INC., CLEVELAND, OHIO.
Evaluation of a developmental heavy metals waste treatment system
[AD-A073131] N80-12959
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
An intermediate-averaged theory for high altitude orbits
[AD-A073094] N80-12104
Research studies on neodymium pentaphosphate miniature lasers
[AD-A073140] N80-12408
Optimization of photovoltaic/thermal collector heat pump systems
[COO-4577-7] N80-12566
Mead, Nebraska, 25-kW photovoltaic power system
[COO-4094-10] N80-12592
Accuracy of parameter estimates for closely spaced optical targets
[AD-A073093] N80-12870
Solid state research
[AD-A-773152] N80-12934
LITTLE [ARTHUR D.], INC., CAMBRIDGE, MASS.
Gas sample storage
[PB-298350/0] N80-12152
Solar Heating And Cooling Of Buildings [SHACOB] Commercialization report. Part B: Analysis of market development, volume 2
[DOE/TIC-10071] N80-12603
LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
Maximum likelihood estimation of label imperfections and its use in the identification of mislabeled patterns
[NASA-CR-160364] N80-12805
LOCKHEED-GEORGIA CO., MARIETTA.
A study of the prediction of cruise noise and laminar flow control noise criteria for subsonic air transports
[NASA-CR-159104] N80-12818
Near-field noise prediction for aircraft in cruising flight: Methods manual
[NASA-CR-159105] N80-12819
LOS ALAMOS NUCLEAR CORP., N. MEX.
Toward a comprehensive model for combustion in a direct injection stratified charge engine
[LA-UR-78-3223] N80-13418
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
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[LA-UR-78-2996] N80-12196
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[LA-UR-78-2895] N80-12197
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[LA-UR-78-2813] N80-12381
Performance of Los Alamos solar Mobile/Modular Home Unit no. 1
[LA-UR-78-2587] N80-12577
Process design of the LASL bismuth sulfate thermochemical hydrogen cycle
[LA-UR-79-1256] N80-12605
High-speed graphics terminal interface for a PDP-11 minicomputer
[LA-7840-MS] N80-12754
Interactive use of computer drawn faces to study multidimensional data
[LA-7752-MS] N80-12774
Block relaxation techniques for finite-element elliptic equations: An example
[LA-7870-MS] N80-12794
Parity violation in the scattering of 15 MeV protons by hydrogen
[LA-UR-78-2875] N80-12835
General purpose heat source project, space nuclear safety program, and radioisotopic terrestrial safety program
[LA-7601-PR] N80-12854
Complementarity between neutron capture and heavy-ion reactions in nuclear structure studies
[LA-UR-78-2432] N80-12863
Experiments on the ZT-S reversed-field pinch, August - December 1978
[LA-7862-MS] N80-12885
Proposal for the theoretical investigation of the relativistic beam-plasma interaction with application to the proof-of-principle electron beam-heated linear solenoidal reactor
[LA-7359-P] N80-12889
Multiple-mirror axial confinement using the fluid model
[LA-7580-MS] N80-12890
Theoretical light and velocity curves for Cepheid variables
[LA-7598-MS] N80-12971
LOUISIANA STATE UNIV., BATON ROUGE.
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[ORO-4881-24] N80-12846
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N80-12322
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[CONF-790602-50] N80-12602

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[AD-A073096] N80-12161
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[ORO-3443-81] N80-12793
High energy accelerator and colliding beam user group
[ORO-2504-273] N80-12857
Black holes and cosmic censorship
N80-12977
MASON AND HANGER-SILAS MASON CO., INC., AMARILLO, TEX.
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[MHSMP-78-45] N80-12181
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
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[AD-A072839] N80-12070
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[NASA-CR-3216] N80-12090
Wake studies related to rearward pyramids
[AD-A073825] N80-12105
Introduction to unsteady flows in turbomachines
N80-12326
Inlet distortion effects in axial compressors
N80-12327
Rotating stall and surge in axial compressors
N80-12328
Photoelectrochemical conversion of optical energy to electricity and fuels
[AD-A072861] N80-12536
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[PB-298291/6] N80-12724
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[AD-A072771] N80-12872
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N80-12011
Flight flutter testing
N80-12012
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N80-12675
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[NASA-CR-162452] N80-12705
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N80-12175
MICHIGAN UNIV., ANN ARBOR.
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N80-12098
Resolution of heat-capacity contributions in lanthanide compounds [thermophysics of the lanthanide trihydroxides]
N80-12116
Increased fracture toughness of graphite-epoxy composites through intermittent interlaminar bonding
N80-12119
Effects of thermal spiking on graphite-epoxy composites
[AD-A072825] N80-12122
Spectroscopic and optically detected magnetic resonance studies of $FO_2^{[-]}$ in potassium chloride
N80-12127
The determination of trace metals in powder micro samples using exploding thin film atomization and excitation
N80-12132
Studies of ultrafine metal particles
N80-12136
Theoretical determination of minimum energy required for the direct initiation of detonations
N80-12186
Millimeter-wave mixers and detectors
[AD-A073991] N80-12284
Survey and description of transport phenomena in packed-beds
N80-12340
Dynamic response of a packed-bed energy storage system to a time varying inlet temperature
N80-12341
Heat storage and thermal transfer aspects of the dynamic behaviour of a packed bed
N80-12342
Heat transfer in a column packed with spheres
N80-12343
A postural measurement system for induced body sway assessment
N80-12729
Rational ways to increase pictographic symbol discriminability
N80-12734
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740
A collection of equation-solving codes for the CRAY-1
[AD-A073033] N80-12769
Linear extremal problems in the class of univalent functions
N80-12779
Electron correlation and Hund's rule
N80-12830
Excitons, phonons, and energy transport in mixed naphthalene crystals: Percolation or Anderson localization
N80-12919
Coherence studies in the first electronic excited singlet state of solid naphthalene
N80-12920
Perturbative applications of quantum chromodynamics
N80-12945
Level-of-service concepts in urban public transportation
[PB-298849/1] N80-12966
The he I triplet line emission in class 1 Seyfert galaxies
N80-12972
Analytic theory of orbit contraction and ballistic entry into planetary atmospheres
N80-12978
MIDWEST RESEARCH INST., GOLDEN, COLO.
Thermoelectric ocean thermal energy conversion [SERI/TP-35-254] N80-12564
Systems Analysis and testing [SAT] program [SERI/PR-35-315] N80-12565
Direct labor requirements for select solar energy technologies: A review and synthesis [SERI/RR-53-045] N80-12573
Wind resource analysis [SERI/TR-36-088] N80-12710
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N80-12688
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[AD-A073008] N80-12445
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[AD-A073143] N80-12268

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[NASA-CR-160303] N80-12257
The NASA bus communications listening device software
[NASA-CR-160304] N80-12258
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[NASA-CR-160382] N80-12440
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[PB-297980/5] N80-12962
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[SAN-1046-T1] N80-12980
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N80-12641

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N80-12646
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N80-12397
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[NASA-TM-81156] N80-12100
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[NASA-TM-78614] N80-12720
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N80-12385
Future progress in the development of the Liniscope
N80-12386
Some contemplated improvements to the prototype Liniscope
N80-12389
Characterization of the Q-switched MOBILAS laser transmitter and its ranging performance relative to a PTM Q-switched system
[NASA-TM-80336] N80-12405
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field
[NASA-TM-80328] N80-12532
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] N80-12533
Interim calibration report for the SIMMR simulator
[NASA-TM-80564] N80-12534
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[NASA-TM-80574] N80-12535
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[NASA-TM-80577] N80-12957
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[NASA-TM-80594] N80-12981
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[NASA-TM-80570] N80-12983
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[NASA-TM-80571] N80-12984
Observations of diffuse galactic gamma rays
[NASA-TM-80579] N80-12985
Micropulsations in the electric field near the plasmapause, observed by ISEE-1
[NASA-TM-80560] N80-12986
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Detection of high energy X-rays from the galactic center region
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[NASA-TP-1552] N80-12084
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[NASA-TP-1539] N80-12085
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[NASA-TM-80169] N80-12086
Technology options for an enhanced air cargo system
[NASA-TM-80173] N80-12076
Behavior of aircraft antiskid braking systems on dry and wet runway surfaces. A slip-velocity-controlled, pressure-bias-modulated system
[NASA-TP-1051] N80-12084
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[NASA-CASE-LAR-12620-1] N80-12117
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[NASA-TM-80156] N80-12398
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[NASA-TM-80178] N80-12732
Validation Methods for Fault-Tolerant avionics and control systems, working group meeting 1
[NASA-CP-2114] N80-12741
Ground effects on aircraft noise
[NASA-TM-80185] N80-12820
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[NASA-TM-80183] N80-12821
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[NASA-CASE-LAR-12328-1] N80-12866
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[NASA-CASE-LEW-12989-1] N80-12414
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[NASA-TM-79318] N80-12552
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[NASA-CASE-NPO-14632-1] N80-12256
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[NASA-CASE-NPO-14258-1] N80-12383
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[NASA-CASE-NPO-13689-2] N80-12549
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[NASA-CASE-NPO-14558-1] N80-12642
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[AD-A071789] N80-12263
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[AD-A072999] N80-12085
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[NASA-CR-160357] N80-12663
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N80-12176
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N80-12051
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N80-12303
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N80-12304
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N80-12305
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N80-12361
A new system of equations for numerical weather forecasting
N80-12656
Numerical solution of a hyperbolic system of conservation laws for blood flow in the arterial tree
N80-12726
High-order accurate solution of Laplace's equation on general regions using integral equation methods and fast Poisson solvers
N80-12781
Lattice and electronic properties of the high temperature superconductor vanadium silicide
N80-12912
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N80-12921
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N80-12136
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N80-12137
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N80-12138
Studies in analytical spectroscopy. 1. Computer treatment of spectroscopy data. 2. Resonance Raman spectroelectrochemistry
N80-12139
Some aspects of the local and global theory of Pfaffian systems
N80-12780
Towards reconstruction of an un-paired random sample
N80-12798
Rank tests for restricted alternative problems in multivariate analysis
N80-12799
Limiting behaviors of certain continuous time-parameter stochastic processes and their applications
N80-12800
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N80-12829
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[ORAU/IEA-79-8[R]] N80-12544
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[CONF-790602-50] N80-12602
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[ORNL/TM-6620] N80-12815
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N80-12364
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, LECLERC [FRANCE].
Modal representation and transfer function of linear dissipative structures
N80-12005
New methods for ground tests of aeronautical structures
N80-12006
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS [FRANCE].
La Recherche Aerospatiale. Bi-monthly Bulletin No. 1978-4
[ESA-TT-561] N80-12013
Calculation of transonic flows around wings
N80-12014
Calculation of the three-dimensional supersonic flow in an axial compressor by a method of characteristics
N80-12015
Calculation - experiment comparisons of the transonic two-dimensional flow in a high-deflection cascade
N80-12016
Application of sputtering to the improvement of coatings of superalloys
N80-12017
A new method of electric measurement of crack length
N80-12018
Preliminary tests in a cryogenic wind tunnel driven by induction
N80-12019
Radiation pressure on a uniform sphere as a function of skin optical properties
N80-12020
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-5
[ESA-TT-555] N80-12021
Separation of a flow along a line of a smooth surface
N80-12022
Restitution of missile trajectories by Kalman filtering-smoothing
N80-12023
Analysis and modelling of the flow within a turbomachine combustor
N80-12024
Aeroacoustic characterization of free jets
N80-12025
Calculation methods associated with the laws of cyclic and damage behavior
N80-12026
Experimental investigation of large scale structures in turbulent jet mixing layers
N80-12027
Homogenization of static thermoelastic properties of media with periodic structures
N80-12028
La Recherche Aerospatiale, Bi-monthly Bulletin No. 1978-6
[ESA-TT-560] N80-12029
ONERA aerodynamic research work on helicopters
N80-12030
Analysis of the separation due to shock wave-turbulent boundary layer interaction in transonic flow
N80-12031
A synthesis of the experience acquired by ONERA on the pogo phenomenon
N80-12032
Synthesis of flight results of the Cactus accelerometer for accelerations below one billionth G
N80-12033
Spectrometer for the first Spacelab payload
N80-12034
Models of turbulent combustion for numerical predictions
N80-12324
OHIO DEPT. OF NATURAL RESOURCES, COLUMBUS.
Method of analysis and precision of X-ray diffraction data from Ohio shale
[METC/CR-78/16] N80-12541
OHIO STATE UNIV., COLUMBUS.
Subsurface electromagnetic target characterization and identification
[AD-A072491] N80-12272

OHIO UNIV., ATHENS.
Human muscle fiber types in power lifters, distance runners and untrained subjects: A histochemical and ultrastructural study
N80-12727

Ultrasonic velocity and absorption measurements in several binary mixtures with pyridine
N80-12817

Low-temperature specific heat measurements of superconducting indium-thallium alloys
N80-12925

OKLAHOMA STATE UNIV., STILLWATER.
Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry
[FE-2537-9] N80-12193

Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Mass spectrometry and fossil-energy conversion technology: A review
[FE-2537-7] N80-12198

OKLAHOMA UNIV., NORMAN.
The crystal and molecular structure of trimethyltin chloride at 135 K, a highly volatile organotin polymer
[AD-A073641] N80-12180

The effectiveness of two and three dimensional interfacial surfaces in communicating magnitude, gradient, and pattern information
N80-12454

Research on the dynamics of band-supported flywheel systems
[SAND-78-7074] N80-12597

Dynamic behavior of single and multiple vortex tornadoes inferred from laboratory simulation
N80-12657

OLD DOMINION UNIV. RESEARCH FOUNDATION, NORFOLK, VA.
A simplified model for the viscous crossflow in a slotted test section
[NASA-CR-3206] N80-12372

The determination of atmospheric trace gases using the correlation interferometer technique
[NASA-CR-162400] N80-12623

OREGON GRADUATE CENTER, BEAVERTON.
Field electron and ion source research for high density information storage system
[AD-A073701] N80-12286

Field electron and ion source research for high density information storage system
[AD-A072541] N80-12932

OREGON STATE UNIV., CORVALLIS.
Estimates for wet and dry removals contribution to the residence time for atmospheric pollutants in the eastern United States
[SR-0980-6] N80-12626

The physical basis of climate
N80-12671

Estimation of the order of an autoregressive time series - a Bayesian approach
N80-12803

P

PATTERN ANALYSIS AND RECOGNITION CORP., ROME, N. Y.
Optimization of computer automated ultrasonic inspection system
[AD-A072677] N80-12423

PENNSYLVANIA COLL. OF PODIATRIC MEDICINE, PHILADELPHIA.
Podiatry
N80-12396

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Vacancy solution and two-dimensional gas models for gas mixture adsorption
N80-12140

Investigation of critical burning of fuel droplets
[NASA-CR-159697] N80-12142

Remote estimation of surface moisture over a watershed
[E80-10025] N80-12527

Aircraft noise and the market for residential housing: Empirical results for seven selected airports
[PB-297681/9] N80-12635

PENNSYLVANIA UNIV., PHILADELPHIA.
Processing fundamentals for intercalation of graphite fibers
[AD-A072943] N80-12121

PITTSBURGH UNIV., PA.
Burning velocities of a solid propellant, via a microwave technique, at elevated pressures and pressurization rates
N80-12187

Inversion of isoparametric mappings and applications of computer graphics to three dimensional finite element analyses
[AD-A073015] N80-12791

Pion-nucleus scattering using finite binding potentials
N80-12850

Effect of dimer dissociation on depolarized scattered light in dilute gases
N80-12864

Single crystal defect studies by means of ion channeling
N80-12917

On the relationship between Lyman-alpha and 21-cm radiation as it applies to clouds of gas associated with quasi-stellar objects
N80-12973

Vertical structure of galactic gaseous disks
N80-12974

PLANETARY SCIENCE INST., TUCSON, ARIZ.
Collisional and dynamical processes in moon and planet formation
[NASA-CR-162530] N80-12979

POLYTECHNIC INST. OF NEW YORK.
Dielectric grating antennas
[AD-A073261] N80-12262

PRATT AND WHITNEY AIRCRAFT GROUP, EAST HARTFORD, CONN.
Design, durability and low cost processing technology for composite fan exit guide vanes
[NASA-CR-159677] N80-12091

PRATT AND WHITNEY AIRCRAFT GROUP, WEST PALM BEACH, FLA.
Improved capabilities to detect incipient bearing failures
[AD-A073123] N80-12416

PRC ENERGY ANALYSIS CO., MCLEAN, VA.
Solar energy commercialization for African countries
[HCP/CS-2522] N80-12591

PRINCETON UNIV., N. J.
Numerical studies of current generation by radio-frequency traveling waves
[PPPL-1506] N80-12296

Finite group actions on simply-connected manifolds and CW complexes
N80-12778

Tearing modes in a plasma with magnetic braiding
[PPPL-1561] N80-12884

Volt-second consumption during the startup phase of a large Tokamak
[PPPL-1508] N80-12888

Systems study of Tokamak fusion-fission reactors
[PPPL-1450] N80-12904

PURDUE UNIV., LAFAYETTE, IND.
Aeroelastic response analysis of two dimensional, single and two degree of freedom airfoils in low-frequency, small-disturbance unsteady transonic flow
[AD-A073379] N80-12073

Performance of buried flexible conduits
[PB-298224/7] N80-12250

Forest resource information system, phase 3
[E80-10026] N80-12528

Q

QUEEN MARY COLL., LONDON [ENGLAND].
Fracture mechanics of inelastic polymers
[AD-A072792] N80-12178

R

RADIO CORP. OF AMERICA, MOORESTOWN, N. J.
Digital signal analysis: Theory and applications
N80-12355

RDP, INC., WALTHAM, MASS.
Atmosphere explorer MESA accelerometer density data base
[AD-A072851] N80-12749

REGIONALE PLANUNGSGEMEINSCHAFT UTERMAIN, FRANKFURT [WEST GERMANY].
Future remote sensing tasks in regional planning
N80-12484

REMAK-ROSENBLOOM, SANTA BARBARA, CALIF.
Implementing packages of congestion-reducing techniques: Strategies for dealing with institutional problems of cooperative programs
[PB-298831/9] N80-12969

RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Seismic vulnerability, behavior and design of buried pipelines, phase 1
[PB-298269/2] N80-12240

A theory of thermoviscoplasticity
N80-12425

General effects of current and sound-speed variations on shortrange acoustic transmission in cyclonic eddies
[AD-A072765] N80-12826

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N. C.
AFAL simulation facility/capability manual. Volume 2: Executive summary. Computer aided design for microelectronics
[AD-A073383] N80-12283

RHODE ISLAND UNIV., KINGSTON.
Characterization of oxidation product films on lead in aqueous media by in situ Raman spectroscopy
N80-12133

Experimental and theoretical investigation of pipe riser clamps
N80-12428

ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
Satellite Power Systems [SPS] concept definition study. Volume 4: SPS point design definition
[NASA-CR-150683] N80-12106

ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Mutual coupling effects on a circular array of dipoles
[AD-A073077] N80-12267

RUHR PLANNING AUTHORITY, ESSEN [WEST GERMANY].
Interpretation of IR and MSS data for town areas
N80-12485

S

SAINT LOUIS UNIV., MO.
A theoretical treatment of hydromagnetic disturbances generated in the outer magnetosphere by discrete solar emissions
N80-12639

Variational Pade approximants applied to the three- and four-body problem
N80-12944

A thermodynamic theory of steady-state systems
N80-12946

SANDIA LABS., ALBUQUERQUE, N. MEX.
Rayleigh temperature profiles in a hydrogen diffusion flame
[SAND-78-8726] N80-12148

High resolution Fourier transform infrared spectroscopy for the investigation of decomposition gases generated by aging organic materials
[SAND-79-0935C] N80-12150

NMR of Cu satellites in the Kondo alloy CuCr
[SAND-78-1514] N80-12165

Solderability
[SAND-78-1749C] N80-12169

Microprocessor-controlled, programmable ramp voltage generator
[SAND-78-8040] N80-12289

Analysis of latch-up prevention in CMOS ICs using an epitaxial-buried layer process
[SAND-78-1648] N80-12292

Laser velocimeter measurements in a constant volume internal combustion engine simulator
[SAND-78-8721] N80-12400

Fracture toughness of steel-aluminum deformation welds
[SAND-78-1736] N80-12419

Experimental verification of a combined environment accelerated aging method applied to electrical cable material
[SAND-78-1907A] N80-12424

Overview of in situ oil shale technology and recent advances in true in situ retort modeling
[SAND-78-2367C] N80-12543

Batteries for specific solar applications
[SAND-79-1428C] N80-12559

Effect of operating temperatures on the cost of energy from solar thermal electric power plants
[SAND-79-0801] N80-12563

Evaluation of solar Rankine-cycle engine systems
[SAND-78-0946] N80-12571

Closed-cycle hydride engines
[SAND-78-2228] N80-12572

Efforts on the economic analysis of Darrieus vertical axis wind turbines
[SAND-78-1851C] N80-12579

Solar mechanical energy storage project
[SAND-78-1982C] N80-12590

Seismic activity generated by hydraulic fracturing
[SAND-78-0072] N80-12649

Wind time series analyses for WECS applications
[SAND-77-1701] N80-12709

Input and table-handling facility for Fortran programs
[SAND-78-1165] N80-12772

Motion of a material whose particle velocity is a linear function of the spatial position
[SAND-78-1423] N80-12814

Evaluation of salt beds in New Mexico as a geologic repository for nuclear waste
[SAND-78-2086C] N80-12853

User's manual for the magnetohydrodynamic generator channel code, MHDCHN
[SAND-78-1260] N80-12994

Effects of additives and moisture on the ionic conductivity of Li5MO4 [M = Al, Ga, Fe]
[SAND-79-0541C] N80-12939

High pressure studies of ionic conductivity in solids
[SAND-79-1511C] N80-12943

SANDIA LABS., LIVERMORE, CALIF.
Materials problems in reversible chemical reaction storage systems for solar energy
[SAND-78-8693] N80-12574

SCIENCE APPLICATIONS, INC., LA JOLLA, CALIF.
Transport and radiation studies of belt pinches and high-beta Tokamaks
[SAI-78-964-LJ] N80-12887

SCIENTIFIC RESEARCH ASSOCIATES, INC., GLASTONBURY, CONN.
Computation of discrete hole film cooling flow using the Navier-Stokes equations
[AD-A073057] N80-12096

SCIENTIFIC RESEARCH ASSOCIATES, INC., ROCKVILLE, MD.
Computational aspects of viscous flows
N80-12371

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
Airborn measurements of optical atmospheric properties, summary and review)
[AD-A073121] N80-12645
SOCIETY OF AUTOMOTIVE ENGINEERS, INC., NEW YORK.
Evaluation and comparison of alternative designs for water/solid-waste processing systems for spacecraft
[NASA-CR-163497] N80-12739
SOUTH DAKOTA STATE UNIV., BROOKINGS.
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution
[E80-10002] N80-12518
SOUTHAMPTON UNIV. [ENGLAND].
Application of data acquisition systems for on-line definition and control of wind tunnel shape
N80-12356
SOUTHERN METHODIST UNIV., DALLAS, TEX.
On the relationship between the R and S arrays and the Box-Jenkins method of ARMA model identification
[AD-A072934] N80-12789
A conditional property of adaptive estimators
[AD-A072991] N80-12790
One-sided tolerance limits for a broad class of lifetime distributions with applications to data of limited accuracy
[AD-A072936] N80-12806
A special distribution result for bilinear forms
[AD-A072933] N80-12808
SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
Contrast enhancement methods for video systems
[AD-A073076] N80-12264
SPERRY RAND CORP., GREAT NECK, N. Y.
A communications trade-off study for computerized traffic control. Volume 2: Appendixes
[PB-298844/2] N80-12967
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Autoradiographic enhancement of Polaroid film
[UCRL-13952] N80-12401
Two-body positive ion-negative neutralization
[AD-A073145] N80-12646
Two-dimensional mesh adjustment algorithm
[AD-A073060] N80-12787
Mechanical intelligence: Research and applications
[AD-A073127] N80-12952
STANFORD UNIV., CALIF.
Improved flow visualization by wine use of Resonant Refractivity
[AD-A073074] N80-12374
STATE UNIV. OF NEW YORK AT ALBANY.
Electromagnetic interactions in relativistic infinite component wave equations
N80-12254
An investigation of the acidity of stratus cloud water and its relationship to droplet distribution, pH of rain, and weather parameters
N80-12616
Na beta-alumina: Structure analysis of a superionic conductor
N80-12924
STATE UNIV. OF NEW YORK AT BINGHAMTON.
Intracavity quenching and dye kinetics of a nitrogen laser pumped dye laser
N80-12403
STATE UNIV. OF NEW YORK AT BUFFALO.
Experimental and theoretical investigation for the suppression of the planar arc drop in the thermionic converter
[NASA-CR-159611] N80-12880
STATE UNIV. OF NEW YORK AT STONY BROOK.
Particle production in high-energy reactions and studies in a gauge model
N80-12848
STEVENS INST. OF TECH., HOBOKEN, N. J.
An X-ray diffraction study of the thermal vibration of atoms in beta-tin
N80-12918
Order parameter relaxation and anomalous conductivity in superconducting tin
N80-12923
STOCKHOLM UNIV. [SWEDEN].
Effects of energy policy on industry
[USFFE-1978-8] N80-12604
Global ecology and man
N80-12668
STUTTGART UNIV. [WEST GERMANY].
Design of supercritical compressor and turbine cascades with a numerical method considering axial velocity density ratio
N80-12368
SYDNEY UNIV. [AUSTRALIA].
Reinforcement to control thermal and shrinkage cracking
[PB-298412/8] N80-12237
Recent concepts: Their influence on code predictions of shrinkage and creep
[PB-298413/6] N80-12238
The effects of freestream turbulence on the galloping behaviour of a square tower
[PB-298744/4] N80-12239
Large deflection analysis of portal frames
[PB-298741/0] N80-12248
The effect of pre-cracking on column behaviour
[PB-298743/6] N80-12439
SYRACUSE UNIV., N. Y.
The magnetic susceptibility of the liquid bismuth-indium alloy system
N80-12126
Oil whirl and critical instabilities in rotor-bearing systems
N80-12412
SYSTEM PLANNING CORP., ARLINGTON, VA.
Data requirements for oceanic processes in the open ocean, coastal zone, and cryosphere
[NASA-CR-162451] N80-12719
SYSTEMS RESEARCH LABS., INC., DAYTON, OHIO.
Preliminary design aerodynamic prediction methodology for missiles with nose blunteners
[AD-A073664] N80-12111

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Modified face seal for positive film stiffness
[NASA-CASE-LEW-12989-1] N80-12414
TECHNISCHE HOCHSCHULE, AACHEN [WEST GERMANY].
High speed blade-wake interactions
N80-12336
TECHNISCHE HOCHSCHULE, DARMSTADT [WEST GERMANY].
On measurements from aircraft
[BMFT-FB-W-78-04] N80-12467
TECHNISCHE UNIVERSITAET, HANOVER [WEST GERMANY].
On the current state of remote sensing techniques
N80-12469
From satellite images to aerial survey photographs: Comparison between observations of the Jade region made with different sensors
N80-12472
Evaluation of thermal images of the Jade region
N80-12475
Determination of currents in coastal regions using multispectral scanning images
N80-12476
Colored substance mixing experiments in the Kieler Bay test region. Comparative evaluation of multispectral scanning and color slide data
N80-12480
Multispectral classification of sand bank regions
N80-12481
Geometrical restitution of multispectral scanning images
N80-12506
TECHNISCHE UNIVERSITAET, MUNICH [WEST GERMANY].
Quantitative determination of morphological structures in sand bank regions from image structure analysis
N80-12482
Making morphological maps of sand banks from aerial photographs
N80-12483
Climatic variability and forestry
N80-12687
TENNESSEE UNIV. SPACE INST., TULLAHOMA.
Refinement of plume modeling in the infrared spectral region
[AD-A072725] N80-12113
TEXACO, INC., EL MONTE, CALIF.
Gasification of residual materials from coal liquefaction. Evaluation of SRC 2 vacuum flash drum bottoms from Powhatan coal as a feedstock for the Texaco gasification processes
[FE-2247-2] N80-12191
TEXAS A&M UNIV., COLLEGE STATION.
Design and analysis of single cell balloons
[AD-A072828] N80-12068
Applied regional monitoring of the vernal advancement and retrogradation [green wave effect] of natural vegetation in the Great Plains corridor
[E80-10008] N80-12524
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] N80-12530
X-ray emission in heavy-ion collision
[ORO-4036-1] N80-12843
TEXAS HISTORICAL COMMISSION, AUSTIN.
Houston Conference on the Revitalization of the Inner City
[PB-299906/9] N80-12965
TEXAS UNIV., AUSTIN.
Research program in elementary particle theory
[ORO-3992-362] N80-12842
TEXAS UNIV. AT AUSTIN.
Shear wave propagation in unconsolidated fluid saturated porous media
[AD-A072867] N80-12827
Analysis of lunar seismic signals: Determination of instrumental parameters and seismic velocity distribution
[NASA-CR-162603] N80-12980
TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK, RIJSWIJK [NETHERLANDS].
Fundamentals of Regenerators
N80-12347
Modelling and simulation of a moving-bed heat-exchange process
N80-12348
TORONTO UNIV. [ONTARIO].
The future role of hydrogen fuel in an electrical society
[UTIAS-241] N80-12189
Applications of random-choice method to problems in shock and detonation-wave dynamics
[UTIAS-240] N80-12373
Climatic variation and variability: Empirical evidence from meteorological and other sources
N80-12669
Human activities that effect climate
N80-12674
TRANSPORTATION RESEARCH BOARD, WASHINGTON, D.C.
Adhesive materials, paints and corrosion
[PB-298941/6] N80-12185
Stabilization and compaction
[PB-298935/8] N80-12244
Relationship of asphalt cement properties to pavement durability
[PB-298833/5] N80-12245
Failure and repair of continuously reinforced concrete pavement
[PB-298832/7] N80-12246
Durability of concrete bridge decks
[PB-298829/3] N80-12247
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Approaches to level 2 analysis based on level 1 results, MEG categories and compounds, and decision criteria
[EPA-600/7-79-063A] N80-12153
TRW EQUIPMENT LABS., CLEVELAND, OHIO.
Second generation PMR polyimide/fiber composites
[NASA-CR-159668] N80-12118
TRW, INC., REDONDO BEACH, CALIF.
Environmental assessment report: Large coal gasification systems for SNG
[PB-296109/0] N80-12204
Emissions assessment of conventional stationary combustion systems. Volume 1: Gas- and oil-fired residential heating sources
[PB-298494/6] N80-12637

U

UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
An experimental and analytical study of boundary layers in highly turbulent freestreams
[AD-A073006] N80-12376
UNIVERSIDADE FEDERAL DE GOIAS, GOIANIA [BRAZIL].
On the existence of simple Liapunov Functions for linear retarded difference differential equations
[AD-A072762] N80-12784
UNIVERSITY HOSPITAL, BASEL [SWITZERLAND].
Climate, health and disease
N80-12679
UTAH UNIV., SALT LAKE CITY.
Elucidation of coal structural components by short residence-time extractive liquefaction
N80-12188
Pressure drop and heat transfer in concurrent downflow of gas-solids suspensions
N80-12308
Statistical representation of electrocardiographic body surface maps for feature identification data compression and classification
N80-12728
Hydrostatic pressure effects on the rotional behavior of molecules and ions in alkali halides, alkali cyanides and beta-alumina
N80-12910

V

VERMONT UNIV. AND STATE AGRICULTURAL COLL., BURLINGTON.
Electron conductivity mobility in semiconductors based on a dielectric function modification of the Dingle impurity ion potential
N80-12922
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Velocity and temperature fields in oscillating boundary layers
N80-12306
Postbuckling studies of curved laminated composite panels
N80-12434
Multiprocessor architectures for supporting secure database management
N80-12742
A comparative study of nonparametric methods in the randomized block design under ordered alternatives
N80-12804
An experimental study of acoustic propagation and attenuation in a circular annular duct with a variable cross-sectional area
N80-12816

Oscillations and waves in anisotropic plasmas
N80-12878

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE [BELGIUM].
Aeroelastic Problems in Aircraft Design
[VKI-LEC-SER-1979-8] N80-12000
Prediction Methods for Turbulent Flows
[VKI-LEC-SER-1979-2] N80-12317
Unsteady flow in turbomachines, volume 1
[VKI-LEC-SER-1979-3-VOL-1] N80-12325
Unsteady flow in turbomachines, volume 2
[VKI-LEC-SER-1979-3-VOL-2] N80-12331
Flow measurements in a rotating stall cell
N80-12334
Blade wake interference: Temperature effect
N80-12335
Rotating stall in axial flow compressors
N80-12337
Fluid Dynamics of Porous Media in Energy Applications, volume 1
[VKI-LEC-SER-1979-4-VOL-1] N80-12338
Fluid Dynamics of Porous Media in Energy Applications, volume 2
[VKI-LEC-SER-1979-4-VOL-2] N80-12346
Hot spot phenomena in active packed beds
N80-12351
A fluorescence method for the measurement of the local voidage in random packed beds
N80-12352
Application of packed beds to energy storage use of latent heat of fusion
N80-12353
Data acquisition systems and data analysis in fluid dynamics
[VKI-LEC-SER-1979-5] N80-12354
Computational Fluid Dynamics
[VKI-LEC-SER-1979-6] N80-12358
The computation of three dimensional viscous flows
N80-12362
On some problems in two and single phase flows
N80-12363
Application of Numerical methods to Flow calculations in turbomachines
[VKI-LEC-SER-1979-7] N80-12365
Introduction to numerical methods: Mathematical concepts and fundamental equations
N80-12366
Time marching methods for turbomachinery flow calculations: Methods of improving convergence
N80-12370

VRIJE UNIVERSITEIT, BRUSSELS [BELGIUM].
Finite element calculations of turbomachinery flows
N80-12367

W

WASHINGTON STATE UNIV., PULLMAN.
Comparison of geothermal energy with coal, oil, and natural gas for selected uses
[DOE/ET-27139-1] N80-12358

WASHINGTON UNIV., ST. LOUIS, MO.
Design and performance evaluation for systems in an uncertain environment
[AD-A073207] N80-12777

WASSERWIRTSCHAFTSAMT WILHELMSHAVEN [WEST GERMANY].
Water quality in coastal regions: Evaluation of thermal images of factory water coolant inlets
N80-12477

WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Passivation studies of iron, nickel, and their alloys by in situ ellipsometric and ex situ ESCA techniques
N80-12157

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Conceptual design of a Demonstration Tokamak Hybrid Reactor [DTHR]
[WFPS-TME-107] N80-12998

WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, PITTSBURGH, PA.
Gallium arsenide vertical channel insulated gate field effect transistor
[AD-A073706] N80-12285
Programmable assembly research technology transfer to industry, phase 2
[PB-299024/4] N80-12961

WICHITA STATE UNIV., KANS.
Wind tunnel force and pressure tests of a 21% thick general aviation airfoil with 20% aileron, 25% slotted flap and 10% slot-lip spoiler
[NASA-CR-3081] N80-12053
Development of the substructural element method for stress analysis
N80-12433

WIEN UNIV. [AUSTRIA].
Aerosol measurements in the submicron size range, studies with an aerosol centrifuge, a new diffusion battery, a low pressure impactor and an advanced condensation nuclei counter
[PB-298073/0] N80-12402

WISCONSIN UNIV. - MADISON.
Photochemistry and photophysics of formyl fluoride
N80-12134
Microwave spectroscopy of the formyl ion, hydrogen isocyanide, and the hydroxyl radical
N80-12135
Oscillatory flow birefringence measurements of block copolymers in solution
N80-12174
Viscoelastic radial flow between parallel disks
N80-12309
The dynamic response of elastic isotropic thin circular cylindrical shells to intense heat
N80-12426
Stresses in the neighborhood of loaded holes in wood with application to bolted joints
N80-12427
Set evaluation
N80-12758
Microwave spectra and theoretical calculation of transient molecules
N80-12828
Ground state energy of molecular trimers
N80-12832
The study of bonding in silicon compounds by Fenske-Hall molecular orbital calculations and photoelectron spectroscopy
N80-12833
Convective cells and their relationship to vortex diffusion in the Wisconsin levitated octupole
N80-12877
Turbulence measurements by digital spectral estimators in the chemically heated Proteclo Tornatron
N80-12879
The transport properties of dilute gases in applied fields
N80-12906
Background study on the development of a standard leaching test
[PB-298280/9] N80-12963

WISCONSIN UNIV. - MILWAUKEE.
Some models of human error for man-machine system evaluation
[AD-A072838] N80-12740

WORLD METEOROLOGICAL ORGANIZATION, GENEVA [SWITZERLAND].
On climate and mankind
[WMO-537] N80-12665
Climatic change and human strategy
N80-12667
Climatic monitoring and climatic data collection services for determining climatic changes and variations. Monitoring data relevant to climate
N80-12673
Global aspects of food production
N80-12680
Climatic variability and agriculture in the temperate regions
N80-12681
Climatic variability, marine resources and offshore development
N80-12a99
Report on discussions held during the first week of the conference
N80-12692
The declaration of the World Meteorological Conference: An appeal to nations
N80-12693
Climate data
N80-12694
Applications of the knowledge of climate
N80-12695
The influence of society on climate change and variability
N80-12696
Impacts of climate change and variability on society
N80-12697
Research on climatic change and variability
N80-12698

WYOMING UNIV., LARAMIE.
Climate and economic activity
N80-12690

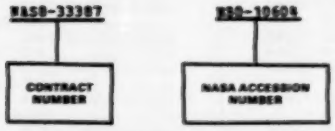
Y

YALE UNIV., NEW HAVEN, CONN.
Skimming stories in real time: An experiment in integrated understanding
N80-12763
Subjective understanding: Computer models of belief systems
N80-12764
Stochastic games, oligopoly theory and competitive resource allocation
[AD-A073030] N80-12810

Z

ZENTRALSTELLE FUER GEO-PHOTOGRAMMETRIE UND FERNERKUNDUNG, MUNICH [WEST GERMANY].
Determination of soil water contents from radiometric measurements and IR scanning data
N80-12494
Preliminary results on the use of digital methods with center of gravity data reduction in a pre-Alp test region
N80-12509

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 649L
N80-12934
AF PROJ. 2001
N80-12868
N80-12869
AF PROJ. 2003
N80-12089
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N80-12146
AF PROJ. 2310
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AF PROJ. 2338
N80-12268
AF PROJ. 2403
N80-12111
AF PROJ. 2416
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N80-12416
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N80-12068
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N80-12749
AF PROJ. 6893
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505-32-03	N00-12820
505-32-03-05	N00-12821
505-32-13-01	N00-12066
505-41-73-03	N00-12732
506-53-53-02	N00-12438
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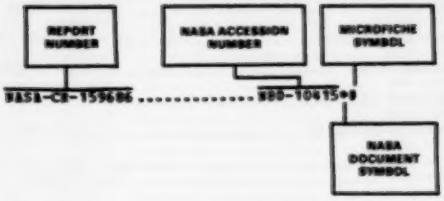
Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-7931 ..... N80-12720*#
A-8012 ..... N80-12100*#

ACR-IR-119 ..... N80-12103*#

AD-A069010 ..... N80-12721 #
AD-A071242 ..... N80-12553 #
AD-A071657 ..... N80-12190 #
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AD-A071789 ..... N80-12263 #
AD-A071811 ..... N80-12110 #
AD-A071916 ..... N80-12415 #
AD-A072143 ..... N80-12378 #
AD-A072491 ..... N80-12272 #
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AD-A072679 ..... N80-12087 #
AD-A072683 ..... N80-12377 #
AD-A072689 ..... N80-12792 #
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AD-A073641 ..... N80-12180 0
AD-A073664 ..... N80-12111 0
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AD-A073825 ..... N80-12105 0

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AD-E200340 ..... N80-12069 0
AD-E400315 ..... N80-12190 0
AD-E430280 ..... N80-12067 0

AED-CONF-78-155-010 ..... N80-12291 0
AED-CONF-78-212-011 ..... N80-12614 0

AEDC-TR-76-112 ..... N80-12074*0
AEDC-TR-79-25 ..... N80-12071 0
AEDC-TR-79-46 ..... N80-12377 0

AER-81-23 ..... N80-12445 0

AEROCHEM-TP-388 ..... N80-12411 0

AF-79-1 ..... N80-12791 0

AFAL-TR-77-118-VOL-2 ..... N80-12283 0
AFAL-TR-77-160 ..... N80-12286 0
AFAL-TR-78-178 ..... N80-12932 0
AFAL-TR-79-1002 ..... N80-12409 0
AFAL-TR-79-1006 ..... N80-12274 0
AFAL-TR-79-1043 ..... N80-12089 0
AFAL-TR-79-1115-VOL-1 ..... N80-12868 0
AFAL-TR-79-1115-VOL-2 ..... N80-12869 0

AFAPL-TR-79-2050 ..... N80-12416 0

AFESC-TR-3-79 ..... N80-12077 0

AFFDL-TR-78-117 ..... N80-12111 0
AFFDL-TR-79-3060 ..... N80-12072 0
AFFDL-TR-79-3077 ..... N80-12073 0

AFGL-TR-78-0258 ..... N80-12068 0
AFGL-TR-78-0286 ..... N80-12645 0
AFGL-TR-79-0039 ..... N80-12646 0
AFGL-TR-79-0060 ..... N80-12883 0
AFGL-TR-79-0062 ..... N80-12749 0
AFGL-TR-79-0122 ..... N80-12700 0

AFIT-LSSR-4-79A N80-12768 0
AFIT-LSSR-20-79A N80-12094 0

AFIT-SLTR-3-72 ..... N80-12949 0

AFIT/GST/MA/79M-1 ..... N80-12788 0

AFL-78-11-45 ..... N80-12071 0

AFML-TR-79-4016 ..... N80-12423 0
AFML-TR-79-4019 ..... N80-12095 0
AFML-TR-79-4034 ..... N80-12121 0
AFML-TR-79-4059 ..... N80-12122 0
AFML-TR-79-4090 ..... N80-12160 0

AFOSR-78-1442TR N80-12785 0
AFOSR-78-1450TR N80-12070 0
AFOSR-79-0897TR N80-12786 0
AFOSR-79-0920TR N80-12784 0
AFOSR-79-0932TR N80-12769 0
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AFOSR-79-0936TR N80-12376 0
AFOSR-79-0937TR N80-12374 0
AFOSR-79-0938TR N80-12787 0
AFOSR-79-0941TR N80-12411 0
AFOSR-79-0952TR N80-12379 0

AFOSR-79-0984TR N80-12105 0

AFWL-TR-78-184 ..... N80-12069 0
AFWL-TR-79-39 ..... N80-12287 0

AGARD-AG-242 ..... N80-12102 0

AGARD-AR-132-VOL-1 ..... N80-12079 0
AGARD-AR-147-VOL-1 ..... N80-12082 0

AGARD-BULL-79/2 ..... N80-12990 0

AIAA-PAPER-80-0098 ..... N80-12822*0

ANSRC-TR-79-39 ..... N80-12123 0

ANRL-TR-79-21 ..... N80-12731 0

ANL-PHS-79-2-VOL-11 ..... N80-12562 0

ANL-78-IX-95 ..... N80-12938 0
ANL-78-109 ..... N80-12897 0

ANL/ICES-TR-20 ..... N80-12581 0
ANL/MED-79-1 ..... N80-12882 0
ANL/MDR-47 ..... N80-12841 0

APL/JHU/TG-1325 ..... N80-12375 0

APR-5 ..... N80-12957*0

AR-1 ..... N80-12376 0
AR-1 ..... N80-12956 0
AR-001-319 ..... N80-12436 0
AR-001-330 ..... N80-12063 0
AR-001-596 ..... N80-12062 0
AR-001-605 ..... N80-12099 0
AR-001-667 ..... N80-12931 0

ARBRL-MR-02915 ..... N80-12067 0

ARL-STRUC-NOTE-374 ..... N80-12436 0

ARL-TR-79-31 ..... N80-12827 0

ARL/AERO-NOTE-384 ..... N80-12063 0
ARL/AERO-NOTE-387 ..... N80-12099 0
ARL/AERO-REPT-151 ..... N80-12062 0

ARLCB-MR-79010 ..... N80-12415 0

ARLCD-MR-78008 ..... N80-12190 0

ARO-13853.3-EL N80-12284 0
ARO-13913.6-P N80-12871 0
ARO-15713.1-EL N80-12262 0

ASD-TR-79-5002 ..... N80-12097 0
ASD-TR-79-5004 ..... N80-12087 0

BDC-BD-1979/16 ..... N80-12382

BCL-OA-TPR-79-1 ..... N80-12958*0

BCL-OA-TPR-79-2 ..... N80-12107*0

BDI-613-1857-REV N80-12293 0
BDI-613-2114 ..... N80-12290 0

BETC/BI-78/6 ..... N80-12203 0

BMFT-FB-W-78-04 ..... N80-12467

BMVG-FBWT-79-3 ..... N80-12310
BMVG-FBWT-79-01 ..... N80-12205

BB-907 ..... N80-12793 0

BNL-26068 ..... N80-12940 0
BNL-50889 ..... N80-12630 0
BNL-50900 ..... N80-12753 0
BNL-50974 ..... N80-12610 0

BS-SNL-TR-79-2 ..... N80-12443 0

CALSPAN-6171-A-2 ..... N80-12069 0

CALT-63-300 ..... N80-12844 0
CALT-822-105 ..... N80-12162 0

CALT-822-107 ..... PB0-12171 ⊕

CERRL-201 ..... PB0-12179 ⊕

CERL-TR-E-264 ..... PB0-12143 ⊕

CSR/DC-14/79 ..... PB0-12078 ⊕

CR-ISSN-0082-5255 ..... PB0-12109 ⊕
CR-ISSN-0082-5255 ..... PB0-12373 ⊕

CONF-780387-1 ..... PB0-12625 ⊕
CONF-780550-10 ..... PB0-12611 ⊕
CONF-780733-3 ..... PB0-12400 ⊕
CONF-780829-10 ..... PB0-12573 ⊕
CONF-780854-5 ..... PB0-12942 ⊕
CONF-780867-1 ..... PB0-12598 ⊕
CONF-780885-1 ..... PB0-12647 ⊕
CONF-780926-21 ..... PB0-12863 ⊕
CONF-780927-1 ..... PB0-12837 ⊕
CONF-780946-4..... PB0-12892 ⊕
CONF-780952-28 ..... PB0-12208 ⊕
CONF-780964-1 ..... PB0-12169 ⊕
CONF-780972-1 ..... PB0-12579 ⊕
CONF-780983-7 ..... PB0-12982 ⊕
CONF-781033-4 ..... PB0-12891 ⊕
CONF-781033-48 ..... PB0-12298 ⊕
CONF-781045-3 ..... PB0-12199 ⊕
CONF-781045-4 ..... PB0-12200 ⊕
CONF-781046-10 ..... PB0-12590 ⊕
CONF-781046-11 ..... PB0-12596 ⊕
CONF-781052-4 ..... PB0-12584 ⊕
CONF-781055-3 ..... PB0-12295 ⊕
CONF-781068-1 ..... PB0-12417 ⊕
CONF-781071-2 ..... PB0-12147 ⊕
CONF-781095-2 ..... PB0-12835 ⊕
CONF-781102-1 ..... PB0-12577 ⊕
CONF-781102-3 ..... PB0-12576 ⊕
CONF-781109-5 ..... PB0-12853 ⊕
CONF-781109-22 ..... PB0-12201 ⊕
CONF-781112-4 ..... PB0-12649 ⊕
CONF-781114-6 ..... PB0-12165 ⊕
CONF-781142-4 ..... PB0-12197 ⊕
CONF-781146-16 ..... PB0-12424 ⊕
CONF-781178-6 ..... PB0-12859 ⊕
CONF-781178-1 ..... PB0-12196 ⊕
CONF-781189-1 ..... PB0-12903 ⊕
CONF-781210-2 ..... PB0-12292 ⊕
CONF-790213-4 ..... PB0-12557 ⊕
CONF-790327-108 ..... PB0-12149 ⊕
CONF-790355-1 ..... PB0-12652 ⊕
CONF-790368-2 ..... PB0-12940 ⊕
CONF-790437-7 ..... PB0-12941 ⊕
CONF-790447-4 ..... PB0-12631 ⊕
CONF-790468-1 ..... PB0-12632 ⊕
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CONF-790538-3 ..... PB0-12939 ⊕
CONF-790540-5 ..... PB0-12873 ⊕
CONF-790541-20 ..... PB0-12566 ⊕
CONF-790602-50 ..... PB0-12602 ⊕
CONF-790607-2 ..... PB0-12651 ⊕
CONF-790631-6 ..... PB0-12564 ⊕
CONF-790632-6 ..... PB0-12150 ⊕
CONF-790675-2 ..... PB0-12874 ⊕
CONF-790709-6 ..... PB0-12943 ⊕
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CONF-790738-2 ..... PB0-12298 ⊕
CONF-790802-13 ..... PB0-12896 ⊕
CONF-790803-08 ..... PB0-12543 ⊕
CONF-790803-25 ..... PB0-12605 ⊕
CONF-790906-15 ..... PB0-12561 ⊕
CONF-791009-2 ..... PB0-12380 ⊕
CONF-7804102-6 ..... PB0-12291 ⊕
CONF-7804108-3 ..... PB0-12614 ⊕
CONF-7805126-5 ..... PB0-12586 ⊕
CONF-7806127-1 ..... PB0-12574 ⊕
CONF-7810149-1 ..... PB0-12381 ⊕
CONF-7810174-1-PT-4/5 ..... PB0-12629 ⊕
CONF-7811102-1 ..... PB0-12418 ⊕
CONF-7811125-1 ..... PB0-12834 ⊕

CONTRIB-3296 ..... PB0-12644*⊕

COO-2456-60 ..... PB0-12905 ⊕
COO-2934-7 ..... PB0-12609 ⊕
COO-4094-10 ..... PB0-12592 ⊕
COO-4184-6-VOL-2 ..... PB0-12895 ⊕
COO-4577-7 ..... PB0-12566 ⊕

CORADCOM-79-3 ..... PB0-12271 ⊕
CORADCOM-79-4 ..... PB0-12270 ⊕
CORADCOM-79-5-PT-2 ..... PB0-12269 ⊕

CRINC-PEL-266-3 ..... PB0-12061*⊕

CSS-TR-26(ONR) ..... PB0-12783 ⊕

DELET-TR-78-0564-2 ..... PB0-12555 ⊕
DELET-TR-79-9 ..... PB0-12936 ⊕
DELET-TR-79-13 ..... PB0-12825 ⊕

DISCUSSION PAPER-525 ..... PB0-12810 ⊕

DLR-FB-77-36 ..... PB0-12035 ⊕
DLR-FB-77-37 ..... PB0-12755 ⊕
DLR-FB-77-56 ..... PB0-12125 ⊕

DOB-TR-159 ..... PB0-12612 ⊕

DOE/EIA-0103/14 ..... PB0-12542 ⊕
DOE/ERA-0048 ..... PB0-12582 ⊕
DOE/ET-0072 ..... PB0-12583 ⊕
DOE/ET-0099 ..... PB0-12899 ⊕
DOE/ET-4064-1 ..... PB0-12600 ⊕
DOE/ET-27139-1 ..... PB0-12558 ⊕
DOE/NASA/0001-79/1 ..... PB0-12551*⊕
DOE/TIC-4579-R10-SUPPL-4 ..... PB0-12601 ⊕
DOE/TIC-10071 ..... PB0-12603 ⊕

DOT-RS-804728 ..... PB0-12421 ⊕

DOT-1-71-1 ..... PB0-12964 ⊕

DOT/MTB/OHBO-77/5 ..... PB0-12183 ⊕
DOT/RSPA/DPB-50/78/24 ..... PB0-12635 ⊕

DRD-HA-732T ..... PB0-12108*⊕
DRD-HA-732T ..... PB0-12109*⊕

DRDMI-HA-78-22 ..... PB0-12422 ⊕

DRDMI-T-78-75 ..... PB0-12075 ⊕
DRDMI-T-79-38 ..... PB0-12407 ⊕

DRL-T-1487 ..... PB0-12108*⊕
DRL-T-1487 ..... PB0-12109*⊕

DTNSRDC-79/074 ..... PB0-12085 ⊕

DTNSRDC/AERO-1260 ..... PB0-12085 ⊕
DTNSRDC/ASED-76/06 ..... PB0-12086 ⊕
DTNSRDC/CMLD-79/07 ..... PB0-12792 ⊕

D6-41063-1-VOL-1 ..... PB0-12054*⊕
D6-41063-2-VOL-2 ..... PB0-12055*⊕
D6-44462-VOL-1 ..... PB0-12056*⊕
D6-44464-VOL-1 ..... PB0-12057*⊕
D6-44466 ..... PB0-12058*⊕
D180-24872-1 ..... PB0-12108*⊕
D180-25461-5-VOL-5 ..... PB0-12109*⊕
D210-11494-1 ..... PB0-12867 ⊕

E-249 ..... PB0-12822*⊕
E-250 ..... PB0-12824*⊕
E-254 ..... PB0-12823*⊕
E-256 ..... PB0-12092*⊕
E-261 ..... PB0-12120*⊕
E-264 ..... PB0-12881*⊕
E-274 ..... PB0-12552*⊕

EDA-79-0135 ..... PB0-12965 ⊕

EMG-216-1 ..... PB0-12236 ⊕

EPA-500/2-79-003 ..... PB0-12173 ⊕
EPA-600/2-79-028 ..... PB0-12633 ⊕
EPA-600/2-79-105 ..... PB0-12402 ⊕
EPA-600/2-79-109 ..... PB0-12963 ⊕
EPA-600/7-79-029B ..... PB0-12637 ⊕
EPA-600/7-79-063A ..... PB0-12153 ⊕
EPA-600/7-79-095 ..... PB0-12152 ⊕
EPA-600/7-79-099 ..... PB0-12636 ⊕
EPA-600/7-79-120 ..... PB0-12204 ⊕
EPA-600/8-79-024 ..... PB0-12968 ⊕

EPRI-FP-1028 ..... PB0-12192 ⊕

ER-79097 ..... NBS-12111*0

ERADCOM/ASL-DR-1029 ..... NBS-12701 0
ERADCOM/ASL-DR-1031 ..... NBS-12706 0
ERADCOM/ASL-DR-1032 ..... NBS-12702 0
ERADCOM/ASL-DR-1033 ..... NBS-12703 0
ERADCOM/ASL-DR-1034 ..... NBS-12705 0
ERADCOM/ASL-DR-1035 ..... NBS-12704 0
ERADCOM/ASL-DR-1037 ..... NBS-12699 0

ERIM-132400-25-R NBS-12529*0

ERL-0037-TR NBS-12081 0
ERL-0077-TR NBS-12931 0

ES-R-1007-01 ..... NBS-12773 0

ESA-TT-500 ..... NBS-12755 0
ESA-TT-518 ..... NBS-12035 0
ESA-TT-524 ..... NBS-12125 0
ESA-TT-555 ..... NBS-12021 0
ESA-TT-560 ..... NBS-12029 0
ESA-TT-561 ..... NBS-12013 0
ESA-TT-564 ..... NBS-12101 0
ESA-TT-580 ..... NBS-12151 0

ESD-TR-78-392 ..... NBS-12400 0
ESD-TR-79-0 ..... NBS-12934 0
ESD-TR-79-125-VOL-1 ..... NBS-12747 0
ESD-TR-79-125-VOL-2 ..... NBS-12748 0
ESD-TR-79-152 ..... NBS-12870 0
ESD-TR-79-164 ..... NBS-12104 0

ESL-784722-3 ..... NBS-12272 0

ESO-10002 ..... NBS-12518*0
ESO-10003 ..... NBS-12519*0
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ESO-10005 ..... NBS-12521*0
ESO-10006 ..... NBS-12522*0
ESO-10007 ..... NBS-12523*0
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ESO-10027 ..... NBS-12529*0
ESO-10028 ..... NBS-12530*0
ESO-10029 ..... NBS-12531*0

FAA-RA-79-151 ..... NBS-12080 0

FCC/OST/SA-79/03 ..... NBS-12275 0

FE-2025-38 ..... NBS-12624 0
FE-2247-2 ..... NBS-12191 0
FE-2537-7 ..... NBS-12198 0
FE-2537-9 ..... NBS-12193 0
FE-2621-3 ..... NBS-12163 0

FHWA/IL/UI-172 ..... NBS-12249 0
FHWA/RS-79/1 ..... NBS-12251 0
FHWA/RD-78/86 ..... NBS-12967 0
FHWA/RD-79-50073 ..... NBS-12250 0

FJSRL-TR-79-0006 ..... NBS-12553 0

FR-3 ..... NBS-12852 0
FR-11509 ..... NBS-12416 0

GA-A-15365 ..... NBS-12896 0

GALCIT-151 ..... NBS-12379 0

GC-D-49-79 ..... NBS-12078 0

GIPP-TIS-391 ..... NBS-12182 0

GP-3704-1060-VOL-2 ..... NBS-12967 0

GIT-ESB-SBA-10 ..... NBS-12444 0
GIT-ESB-SBA-14 ..... NBS-12446 0

GPO-31-469 ..... NBS-12956 0
GPO-34-857 ..... NBS-12660 0
GPO-41-481 ..... NBS-12550 0

GSC-1070-05-79-CR NBS-12950 0

GSA/FPA/MCL-TR-274 ..... NBS-12756 0

GSTR-79-9 ..... NBS-12623*0

GUBC-REPT-165 ..... NBS-12624 0

HAC-PR-79-27-676 ..... NBS-12733 0

HAC-REP-H3980 ..... NBS-12733 0

HCP/CS-2522 ..... NBS-12591 0
HCP/ET/4000-78/1 ..... NBS-12202 0
HCP/R2165 ..... NBS-12606 0
HCP/T3540-01 ..... NBS-12587 0
HCP/T4016-1 ..... NBS-12707 0
HCP/W6354-01 ..... NBS-12567 0

HDL-TR-79-19 ..... NBS-12770 0

HDL-TR-1891 ..... NBS-12265 0

HEDL-SA-1559 ..... NBS-12147 0

HST-TR-344-0 ..... NBS-12059*0

ICRA-79-08 ..... NBS-12791 0

IIT-R/CE-79-2 ..... NBS-12437 0

IRPE-1540-RPR/065 ..... NBS-12519*0

IR-4 ..... NBS-12932 0

IS-R-166 ..... NBS-12576 0
IS-R-167 ..... NBS-12168 0
IS-R-202 ..... NBS-12611 0

IS-T-822 ..... NBS-12838 0
IS-T-825 ..... NBS-12847 0

IS-TRANS-106 ..... NBS-12937 0

ISBN-0-309-02836-1 ..... NBS-12244 0
ISBN-0-309-02838-8 ..... NBS-12185 0
ISBN-0-309-02910-4 ..... NBS-12184 0
ISBN-0-309-02911-2 ..... NBS-12245 0
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ITB-3 ..... NBS-12286 0

JHEP-78-24 ..... NBS-12259 0

JSC-16006 ..... NBS-12257*0
JSC-16054 ..... NBS-12258*0
JSC-16067 ..... NBS-12805*0
JSC-16075 ..... NBS-12746*0

L-11760 ..... NBS-12084*0
L-13060 ..... NBS-12066*0
L-13142 ..... NBS-12065*0
L-13144 ..... NBS-12438*0
L-13158 ..... NBS-12064*0
L-13246 ..... NBS-12398*0
L-13404 ..... NBS-12718*0
L-13436 ..... NBS-12741*0

LA-UR-78-2432 ..... NBS-12863 0
LA-UR-78-2587 ..... NBS-12577 0
LA-UR-78-2813 ..... NBS-12381 0
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LA-UR-78-3223 ..... NBS-12418 0
LA-UR-79-1256 ..... NBS-12605 0

LA-7359-P NBS-12889 0
LA-7580-MS NBS-12890 0
LA-7598-MS NBS-12971 0

LA-7601-PR ..... N80-12854 #
LA-7752-MS ..... N80-12774 #
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LBL-8211 ..... N80-12836 #
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LBL-8308 ..... N80-12586 #
LBL-8371 ..... N80-12647 #
LBL-8391 ..... N80-12982 #
LBL-8777 ..... N80-12652 #
LBL-8859 ..... N80-12149 #
LBL-8948 ..... N80-12845 #
LBL-9095 ..... N80-12947 #
LBL-9381 ..... N80-12300 #

LC-79-17217 ..... N80-12185 #
LC-79-17962 ..... N80-12248 #
LC-79-64881 ..... N80-12247 #
LC-79-65727 ..... N80-12245 #
LC-79-65828 ..... N80-12184 #
LC-79-66248 ..... N80-12969 #
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LG78ER0218 ..... N80-12818*#
LG78ER0219 ..... N80-12819*#

LSI-ER-314-80-6 ..... N80-12959 #

LTR-141-101 ..... N80-12420 #

M-101 ..... N80-12449 #

MEIC/CR-78/16 ..... N80-12541 #

MESRP-78-45 ..... N80-12181 #

MIT-TR-203 ..... N80-12070 #
MIT-TR-205 ..... N80-12105 #

MITSG-79/13 ..... N80-12724 #

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MSC-06779 ..... N80-12282*#

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MTR-3618-VOL-1 ..... N80-12747 #
MTR-3618-VOL-2 ..... N80-12748 #
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MTR-3787-VOL-2 ..... N80-12261*#
MTR-4722 ..... N80-12440*#
MTR-4728 ..... N80-12257*#
MTR-4729 ..... N80-12258*#

NAL-TR-569T ..... N80-12435 #

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NASA-CASE-LAR-12620-1 ..... N80-12117*#

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NASA-CASE-NPO-14324-1 ..... N80-12851*#
NASA-CASE-NPO-14558-1 ..... N80-12642*#
NASA-CASE-NPO-14632-1 ..... N80-12256*#

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NASA-CP-2112 ..... N80-12384*#
NASA-CP-2114 ..... N80-12741*#

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NASA-CR-2853 ..... N80-12056*#
NASA-CR-2855 ..... N80-12057*#
NASA-CR-2857 ..... N80-12058*#
NASA-CR-3081 ..... N80-12053*#
NASA-CR-3091 ..... N80-12662*#
NASA-CR-3102 ..... N80-12060*#
NASA-CR-3205 ..... N80-12061*#
NASA-CR-3206 ..... N80-12372*#
NASA-CR-3209 ..... N80-12776*#
NASA-CR-3216 ..... N80-12090*#
NASA-CR-137697 ..... N80-12059*#
NASA-CR-150683 ..... N80-12106*#
NASA-CR-159104 ..... N80-12810*#
NASA-CR-159105 ..... N80-12819*#
NASA-CR-159599 ..... N80-12551*#
NASA-CR-159611 ..... N80-12880*#
NASA-CR-159666 ..... N80-12110*#
NASA-CR-159677 ..... N80-12091*#
NASA-CR-159682 ..... N80-12260*#
NASA-CR-159684 ..... N80-12261*#
NASA-CR-159697 ..... N80-12142*#
NASA-CR-159703 ..... N80-12259*#
NASA-CR-160280 ..... N80-12620*#
NASA-CR-160346 ..... N80-12528*#
NASA-CR-160350 ..... N80-12530*#
NASA-CR-160351 ..... N80-12529*#
NASA-CR-160357 ..... N80-12663*#
NASA-CR-160358 ..... N80-12664 #
NASA-CR-160364 ..... N80-12805*#
NASA-CR-160369 ..... N80-12108*#
NASA-CR-160380 ..... N80-12109*#
NASA-CR-160382 ..... N80-12440*#
NASA-CR-160383 ..... N80-12257*#
NASA-CR-160384 ..... N80-12258*#
NASA-CR-160385 ..... N80-12103*#
NASA-CR-161213 ..... N80-12765*#
NASA-CR-161329 ..... N80-12538*#
NASA-CR-161330 ..... N80-12539*#
NASA-CR-161331 ..... N80-12540*#
NASA-CR-162368 ..... N80-12527*#
NASA-CR-162379 ..... N80-12518*#
NASA-CR-162380 ..... N80-12519*#
NASA-CR-162381 ..... N80-12520*#
NASA-CR-162382 ..... N80-12521*#
NASA-CR-162383 ..... N80-12522*#
NASA-CR-162384 ..... N80-12523*#
NASA-CR-162385 ..... N80-12524*#
NASA-CR-162394 ..... N80-12525*#
NASA-CR-162395 ..... N80-12526*#
NASA-CR-162397 ..... N80-12531*#
NASA-CR-162451 ..... N80-12719*#
NASA-CR-162452 ..... N80-12735*#
NASA-CR-162454 ..... N80-12958*#
NASA-CR-162460 ..... N80-12745*#
NASA-CR-162480 ..... N80-12623*#
NASA-CR-162491 ..... N80-12702*#
NASA-CR-162492 ..... N80-12739*#
NASA-CR-162500 ..... N80-12979*#
NASA-CR-162501 ..... N80-12766*#
NASA-CR-162502 ..... N80-12255*#
NASA-CR-162602 ..... N80-12644*#
NASA-CR-162603 ..... N80-12980*
NASA-CR-162604 ..... N80-12107*#

NASA-RP-1044 ..... N80-12661*#

NASA-SP-7037(114) N80-11999*

NASA-TM-78614 ..... N80-12720*#
NASA-TM-79298 ..... N80-12822*#
NASA-TM-79300 ..... N80-12824*#
NASA-TM-79302 ..... N80-12823*#
NASA-TM-79304 ..... N80-12092*#
NASA-TM-79306 ..... N80-12120*#
NASA-TM-79308 ..... N80-12881*#
NASA-TM-79318 ..... N80-12552*#
NASA-TM-80156 ..... N80-12398*#
NASA-TM-80169 ..... N80-12066*#
NASA-TM-80173 ..... N80-12076*#
NASA-TM-80178 ..... N80-12732*#
NASA-TM-80183 ..... N80-12821*#
NASA-TM-80185 ..... N80-12820*#
NASA-TM-80328 ..... N80-12532*#
NASA-TM-80336 ..... N80-12405*#
NASA-TM-80557 ..... N80-12533*#
NASA-TM-80564 ..... N80-12534*#

NASA-TM-80570 ..... N80-12983*#
NASA-TM-80571 ..... N80-12984*#
NASA-TM-80573 ..... N80-12622*#
NASA-TM-80574 ..... N80-12535*#
NASA-TM-80576 ..... N80-12536*#
NASA-TM-80577 ..... N80-12957*#
NASA-TM-80578 ..... N80-12985*#
NASA-TM-80579 ..... N80-12970*#
NASA-TM-80580 ..... N80-12986*#
NASA-TM-80581 ..... N80-12987*#
NASA-TM-80584 ..... N80-12988*#
NASA-TM-80586 ..... N80-12643*#
NASA-TM-80588 ..... N80-12989*#
NASA-TM-80589 ..... N80-12537*#
NASA-TM-80594 ..... N80-12981*#
NASA-TM-80831 ..... N80-12282*#
NASA-TM-81156 ..... N80-12100*#

NASA-TP-1851 ..... N80-12084*#
NASA-TP-1534 ..... N80-12438*#
NASA-TP-1539 ..... N80-12065*#
NASA-TP-1552 ..... N80-12064*#
NASA-TP-1575 ..... N80-12399*#

NATICK/TR-79/031 ..... N80-12179 #

NBS-BIR-63-7-8 ..... N80-12242 #

NBS-OCR-79-170 ..... N80-12299 #

NBS-SP-400-14 ..... N80-12301 #
NBS-SP-551 ..... N80-12279 #

NBS-TN-1014 ..... N80-12276 #

NBSIR-79-1756 ..... N80-12309 #
NBSIR-79-1760 ..... N80-12183 #
NBSIR-79-1790 ..... N80-12252 #

NOAA-TR-ERL-SEL-53 ..... N80-12112 #

NOAA-TR-NES-98-139 ..... N80-12713 #
NOAA-TR-NES-98-140 ..... N80-12716 #
NOAA-TR-NES-98-141 ..... N80-12715 #

NOAA-79031609 ..... N80-12546 #
NOAA-79061312 ..... N80-12112 #
NOAA-79061802 ..... N80-12723 #
NOAA-79061803 ..... N80-12722 #
NOAA-79061811 ..... N80-12724 #
NOAA-79062001 ..... N80-12653 #
NOAA-79062901 ..... N80-12717 #
NOAA-79062907 ..... N80-12713 #
NOAA-79062908 ..... N80-12716 #
NOAA-79062909 ..... N80-12715 #
NOAA-79070301 ..... N80-12725 #
NOAA-79070910 ..... N80-12634 #

NOSC/TD-216 ..... N80-12263 #
NOSC/TR-387 ..... N80-12406 #

NRL-MR-3930 ..... N80-12378 #
NRL-MR-3957 ..... N80-12410 #
NRL-MR-3970 ..... N80-12145 #

NSF/RA-780608 ..... N80-12615 #
NSF/RA-790069 ..... N80-12241 #
NSF/RA-790070 ..... N80-12961 #
NSF/RA-790093 ..... N80-12240 #
NSF/RA-790121 ..... N80-12451 #
NSF/RA-790122 ..... N80-12450 #

NTIA/REPT-79/20 ..... N80-12278 #
NTIA/REPT-79/21 ..... N80-12277 #

NU-SEL-TR-79-1 ..... N80-12442 #

NUREG-CR-0579 ..... N80-12855 #
NUREG-CR-0683 ..... N80-12809 #

NWC-TM-3589 ..... N80-12663*#
NWC-TM-3666 ..... N80-12664 #

NWC-TP-6187 ..... N80-12733 #

ONERA-NT-1978-6 ..... N80-12101 #
ONERA-NT-1978-7 ..... N80-12151 #

ONR-CR-212-255-1F ..... N80-12093 #

OR-15448 ..... N80-12123 #

ORAU/IEA-78-17(M) ..... N80-12594 #
ORAU/IEA-78-20(M) ..... N80-12595 #
ORAU/IEA-78-24-(M) ..... N80-12711 #
ORAU/IEA-79-8(M) ..... N80-12584 #

ORNL/CDP-27 ..... N80-12580 #
ORNL/SUB-7321-1 ..... N80-12613 #
ORNL/TM-6533 ..... N80-12575 #
ORNL/TM-6575 ..... N80-12901 #
ORNL/TM-6605 ..... N80-12568 #
ORNL/TM-6620 ..... N80-12815 #
ORNL/TM-6624 ..... N80-12170 #
ORNL/TM-6668 ..... N80-12599 #

ORO-2584-273 ..... N80-12857 #
ORO-3443-81 ..... N80-12793 #
ORO-3992-355 ..... N80-12862 #
ORO-3992-362 ..... N80-12842 #
ORO-4881-24 ..... N80-12846 #
ORO-4936-1 ..... N80-12843 #

PB-294616 ..... N80-12546 #
PB-296479/9 ..... N80-12615 #
PB-297221/4 ..... N80-12275 #
PB-297442/6 ..... N80-12547 #
PB-297466/5 ..... N80-12636 #
PB-297511/8 ..... N80-12112 #
PB-297681/9 ..... N80-12635 #
PB-297743/7 ..... N80-12453 #
PB-297744/5 ..... N80-12452 #
PB-297977/1 ..... N80-12277 #
PB-297980/5 ..... N80-12962 #
PB-298047/2 ..... N80-12183 #
PB-298073/8 ..... N80-12402 #
PB-298109/0 ..... N80-12204 #
PB-298229/7 ..... N80-12250 #
PB-298248/6 ..... N80-12633 #
PB-298262/7 ..... N80-12450 #
PB-298266/8 ..... N80-12241 #
PB-298267/6 ..... N80-12451 #
PB-298269/2 ..... N80-12240 #
PB-298280/9 ..... N80-12963 #
PB-298291/6 ..... N80-12728 #
PB-298318/7 ..... N80-12301 #
PB-298323/7 ..... N80-12251 #
PB-298339/3 ..... N80-12713 #
PB-298350/0 ..... N80-12152 #
PB-298355/9 ..... N80-12717 #
PB-298360/9 ..... N80-12655 #
PB-298372/4 ..... N80-12242 #
PB-298412/8 ..... N80-12237 #
PB-298413/6 ..... N80-12238 #
PB-298445/8 ..... N80-12243 #
PB-298494/6 ..... N80-12637 #
PB-298495/3 ..... N80-12249 #
PB-298497/9 ..... N80-12714 #
PB-298537/2 ..... N80-12722 #
PB-298556/2 ..... N80-12654 #
PB-298574/5 ..... N80-12390 #
PB-298577/8 ..... N80-12775 #
PB-298605/7 ..... N80-12276 #
PB-298612/3 ..... N80-12968 #
PB-298613/1 ..... N80-12715 #
PB-298668/5 ..... N80-12278 #
PB-298674/3 ..... N80-12716 #
PB-298675/0 ..... N80-12279 #
PB-298716/2 ..... N80-12653 #
PB-298726/1 ..... N80-12725 #
PB-298731/1 ..... N80-12756 #
PB-298736/0 ..... N80-12634 #
PB-298741/0 ..... N80-12248 #
PB-298743/6 ..... N80-12439 #
PB-298744/4 ..... N80-12239 #
PB-298776/6 ..... N80-12953 #
PB-298780/7 ..... N80-12723 #
PB-298809/5 ..... N80-12252 #
PB-298829/3 ..... N80-12247 #
PB-298831/9 ..... N80-12969 #
PB-298832/7 ..... N80-12246 #
PB-298833/5 ..... N80-12245 #
PB-298841/8 ..... N80-12173 #
PB-298844/2 ..... N80-12967 #
PB-298849/1 ..... N80-12966 #
PB-298906/9 ..... N80-12965 #
PB-298907/7 ..... N80-12964 #
PB-298933/3 ..... N80-12421 #

PB-290935/8 ..... NBS-12244 #
PB-290941/6 ..... NBS-12105 #
PB-290942/4 ..... NBS-12104 #
PB-299024/8 ..... NBS-12961 #
PB-299172/7 ..... NBS-12299 #

PB-206 ..... NBS-12382

PBL-SA-6831-PT-2 ..... NBS-12573 #

PBL-2823 ..... NBS-12893 #
PBL-2920 ..... NBS-12809 #

POLY-MRI-1401-79 ..... NBS-12262 #

PPPL-1450 ..... NBS-12904 #
PPPL-1506 ..... NBS-12296 #
PPPL-1508 ..... NBS-12888 #
PPPL-1561 ..... NBS-12884 #

PR-1 ..... NBS-12523*#

PSAD-79-62 ..... NBS-12953 #

PUBL-1362-01-1-2032 ..... NBS-12255*#

PWA-5570-37 ..... NBS-12091*#

QPB-1 ..... NBS-12560 #

QR-1 ..... NBS-12961 #
QR-2 ..... NBS-12555 #

R-ILC-77-4/F ..... NBS-12409 #

R-331 ..... NBS-12248 #
R-334 ..... NBS-12237 #
R-338 ..... NBS-12239 #
R-343 ..... NBS-12238 #
R-344 ..... NBS-12439 #

RADC-TR-79-82 ..... NBS-12267 #
RADC-TR-79-138 ..... NBS-12273 #
RADC-TR-79-154 ..... NBS-12266 #
RADC-TR-79-172 ..... NBS-12260 #

REPT-36 ..... NBS-12455
REPT-78-6 ..... NBS-12658 #
REPT-79-9F7-VHIST-R1 ..... NBS-12285 #
REPT-1842-EDG/EETE/TR-79-12 ..... NBS-12750 #
REPT-014525-F ..... NBS-12284 #

RFP-TRANS-250 ..... NBS-12166 #
RFP-TRANS-256 ..... NBS-12167 #

RHO-LD-66 ..... NBS-12858 #

RLG/2221-T14/1 ..... NBS-12558 #

RPI-MATH-125 ..... NBS-12826 #

RSC-3018-7 ..... NBS-12524*#
RSC-3556 ..... NBS-12530*#

R79-910002-1 ..... NBS-12096 #

S-REPT-96-52 ..... NBS-12621 #

S-129-TP ..... NBS-12891 #
S-497 ..... NBS-12399*#

SAI-1-181-00-633-83 ..... NBS-12979*#
SAI-78-964-LJ ..... NBS-12887 #

SANSO-TR-79-48 ..... NBS-12110 #

SAR-1846-T1 ..... NBS-12560 #

SAND-77-1701 ..... NBS-12709 #
SAND-78-0072 ..... NBS-12649 #
SAND-78-0986 ..... NBS-12571 #
SAND-78-1165 ..... NBS-12772 #
SAND-78-1260 ..... NBS-12894 #
SAND-78-1423 ..... NBS-12814 #
SAND-78-1514 ..... NBS-12165 #
SAND-78-1648 ..... NBS-12292 #
SAND-78-1736 ..... NBS-12419 #
SAND-78-1749C ..... NBS-12169 #
SAND-78-1851C ..... NBS-12579 #

SAND-78-1907A ..... NBS-12424 #
SAND-78-1982C ..... NBS-12590 #
SAND-78-2006C ..... NBS-12853 #
SAND-78-2228 ..... NBS-12572 #
SAND-78-2367C ..... NBS-12583 #
SAND-78-7078 ..... NBS-12597 #
SAND-78-0040 ..... NBS-12289 #
SAND-78-0693 ..... NBS-12574 #
SAND-78-8721 ..... NBS-12400 #
SAND-78-8726 ..... NBS-12948 #
SAND-79-0541C ..... NBS-12939 #
SAND-79-0801 ..... NBS-12563 #
SAND-79-0935C ..... NBS-12150 #
SAND-79-1428C ..... NBS-12559 #
SAND-79-1511C ..... NBS-12943 #
SAND-79-8187 ..... NBS-12608 #

SD-33 ..... NBS-12421 #

SCIENTIFIC-1 ..... NBS-12068 #

SD-78-AP-0023-4-VOL-4 ..... NBS-12106*#

SDSS-RSI-79-15 ..... NBS-12518*#

SE-17 ..... NBS-12653 #

SEL-133 ..... NBS-12769 #

SERI/PR-35-313 ..... NBS-12565 #
SERI/RR-53-065 ..... NBS-12578 #
SERI/TP-35-258 ..... NBS-12564 #
SERI/TR-36-088 ..... NBS-12710 #

SERIAL-T-403 ..... NBS-12767 #

SID-REP-79-5 ..... NBS-12605 #

SOLAR/0010-78-10 ..... NBS-12585 #
SOLAR/0801-79-01 ..... NBS-12607 #

SOR-4106-9 ..... NBS-12264 #

SORI-EAS-79-330 ..... NBS-12264 #

SR-0980-6 ..... NBS-12626 #

SRI-RP-79-810 ..... NBS-12646 #

TR-SER-20 ..... NBS-12249 #

TPBP-TR-292 ..... NBS-12164 #

TID-28964 ..... NBS-12593 #

TR-1979-25 ..... NBS-12104 #
TR-1979-43 ..... NBS-12870 #

TR-1 ..... NBS-12444 #
TR-2 ..... NBS-12446 #
TR-2-ORR ..... NBS-12556 #
TR-3 ..... NBS-12177 #
TR-6 ..... NBS-12935 #
TR-8 ..... NBS-12180 #
TR-9 ..... NBS-12240 #
TR-15 ..... NBS-12659 #
TR-16 ..... NBS-12658 #
TR-22.2290 ..... NBS-12933 #
TR-79-5 ..... NBS-12740 #
TR-79-02 ..... NBS-12448 #
TR-79-5001 ..... NBS-12771 #
TR-131 ..... NBS-12808 #
TR-133 ..... NBS-12790 #
TR-134 ..... NBS-12789 #
TR-135 ..... NBS-12806 #
TR-0079(4550-83)-1 ..... NBS-12110 #

TRB/BCHRP/REP-204 ..... NBS-12184 #
TRB/BCHRP/REP-205 ..... NBS-12969 #
TRB/BCHRP/STR-57 ..... NBS-12247 #
TRB/BCHRP/STR-59 ..... NBS-12245 #
TRB/BCHRP/STR-60 ..... NBS-12246 #
TRB/TRR-690 ..... NBS-12244 #
TRB/TRR-692 ..... NBS-12185 #

UCB/EERC-78/29 ..... NBS-12243 #
UCB/EERC-79/01 ..... NBS-12451 #
UCB/EERC-79/03 ..... NBS-12450 #
UCB/EERC-79/04 ..... NBS-12241 #

OCR/PTR-79/9 ..... NBS-12721 #

OCRI-CPL-79-55 ..... NBS-12654 #

OCID-17940-REV-1 ..... NBS-12955 #
OCID-17949 ..... NBS-12569 #
OCID-17990 ..... NBS-12886 #
OCID-17992 ..... NBS-12902 #
OCID-18024 ..... NBS-12196 #
OCID-18122 ..... NBS-12860 #

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OCRL-TRANS-1572 ..... NBS-12948 #
OCRL-TRANS-11392 ..... NBS-12650 #

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OCRL-13914 ..... NBS-12297 #
OCRL-13917-VOL-1 ..... NBS-12856 #
OCRL-13919 ..... NBS-12773 #
OCRL-13938 ..... NBS-12852 #
OCRL-13952 ..... NBS-12401 #
OCRL-13969 ..... NBS-12840 #
OCRL-13976 ..... NBS-12195 #
OCRL-15002 ..... NBS-12628 #
OCRL-52541 ..... NBS-12545 #
OCRL-52583 ..... NBS-12570 #
OCRL-52603 ..... NBS-12627 #
OCRL-52626 ..... NBS-12855 #
OCRL-52680 ..... NBS-12712 #
OCRL-81537 ..... NBS-12834 #
OCRL-81578 ..... NBS-12892 #
OCRL-81596 ..... NBS-12942 #
OCRL-81736 ..... NBS-12584 #
OCRL-81786 ..... NBS-12596 #
OCRL-81841 ..... NBS-12201 #
OCRL-81890 ..... NBS-12900 #
OCRL-81936 ..... NBS-12903 #
OCRL-81973 ..... NBS-12873 #
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OCRL-82051 ..... NBS-12124 #
OCRL-82129 ..... NBS-12839 #
OCRL-82177 ..... NBS-12859 #
OCRL-82553 ..... NBS-12651 #
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OCRL-83011 ..... NBS-12561 #

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OILS-ENG-79-1702 ..... NBS-12807 #

OIRC/ENG-77-2018 ..... NBS-12249 #

OIOCDCS-R-79-957 ..... NBS-12807 #

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ONIA-YA-06-0053-79-1 ..... NBS-12962 #

ONC-SC-78-17 ..... NBS-12634 #

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UTIAS-241 ..... NBS-12189 #

UTRC/R78-914388-5 ..... NBS-12376 #

VAAP-00-2 ..... NBS-12937 #

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VKI-LEC-SER-1979-3-VOL-2 ..... NBS-12331 #
VKI-LEC-SER-1979-4-VOL-1 ..... NBS-12338 #
VKI-LEC-SER-1979-4-VOL-2 ..... NBS-12346 #
VKI-LEC-SER-1979-5 ..... NBS-12354 #
VKI-LEC-SER-1979-6 ..... NBS-12358 #
VKI-LEC-SER-1979-7 ..... NBS-12365 #
VKI-LEC-SER-1979-8 ..... NBS-12000 #

WES-EL-SP-79-6 ..... NBS-12751 #

WFPS-TRB-107 ..... NBS-12898 #

WHO-537 ..... NBS-12665 #

WSB-AR-77-6 ..... NBS-12053*#

Y-2171 ..... NBS-12172 #

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